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

2023

COMPUTER BASED TEST (CBT) Questions & Solutions

Date: 24 January, 2023 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300






SUBJECT: CHEMISTRY

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PART : CHEMISTRY

31. What is the number of unpaired electron(s) in the highest occupied molecular orbital of the following species : N_2 ; N_2^+ ; O_2 ; O_2^+ ?

- (1) 0,1,2,1 (2) 2,1,2,1 (3) 0,1,0,1 (4) 2,1,0,1

NTA. (1)

RESO. (1)

Sol.	Species	Number of unpaired electron
	$(N_2) : (\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\pi 2p_x = \pi 2p_y)^2 (\sigma 2p_z)^2$	0
	$(N_2^+) : (\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\pi 2p_x = \pi 2p_y)^2 (\sigma 2p_z)^1$	1
	$(O_2) : (\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\sigma 2p_z)^2 (\pi 2p_x = \pi 2p_y)^2 (\pi^* 2p_x^1 = \pi^* 2p_y^1)$	2
	$(O_2^+) : (\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\sigma 2p_z)^2 (\pi 2p_x = \pi 2p_y)^2 (\pi^* 2p_x^1 = \pi^* 2p_y^0)$	1

32. Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion A : Benzene is more stable than hypothetical cyclohexatriene

Reason R : The delocalized π electron cloud is attracted more strongly by nuclei of carbon atoms. In the light of the above statements, choose the correct answer from the option

- (1) A is false but R is true
 (2) Both A and R are correct but R is not the correct explanation of A
 (3) A is true but R is false
 (4) Both A and R are correct and R is the correct explanation of A.

NTA. (4)

RESO. (4)

Sol. Benzene has resonance energy 36 Kcal per mole.

33. Which one amongst the following are good oxidizing agents ?

- A. Sm^{2+}
 B. Ce^{2+}
 C. Ce^{4+}
 D. Tb^{4+}

Choose the most appropriate answer from the option given below :

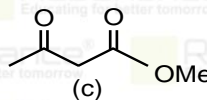
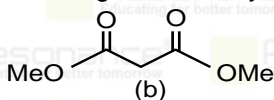
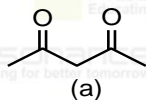
- (1) D only (2) C and D only (3) C only (4) A and B only

NTA. (2)

RESO. (2)

Sol. Both Ce^{4+} and Tb^{4+} act as oxidising agent.

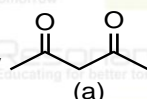
34. Which will undergo deprotonating most readily in basic medium



- (1) Both a and c (2) a only (3) b only (4) c only

NTA. (2)

RESO. (2)

Sol. Most stable anion is produced by  (a)

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35. In which of the following reaction the hydrogen peroxide acts as a reducing agent ?

- (1) $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$ (2) $2\text{Fe}^{2+} + \text{H}_2\text{O}_2 \rightarrow 2\text{Fe}^{3+} + 2\text{OH}^-$
 (3) $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$ (4) $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{4+} + 2\text{OH}^-$

NTA. (3)

RESO. (3)

Sol. $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$

In this reaction H_2O_2 reduce HOCl to Cl^- and it self get oxidised to O_2 .

36. The number of s-electrons present in an ion with 55 protons in its unipositive state is

- (1) 8 (2) 12 (3) 9 (4) 10

NTA. (4)

RESO. (4)

Sol. $\text{Cs}^{+1} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6$

Total number of s-electrons = 10

37. Which of the following cannot be explained by crystal field theory ?

- (1) Magnetic properties of transition metal complexes
 (2) The order of spectrochemical series
 (3) Colour of metal complexes
 (4) Stability of metal complexes

NTA. (4)

RESO. (2)

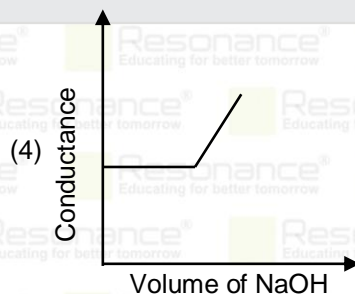
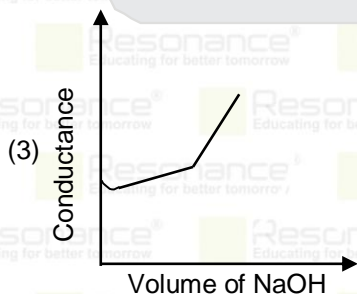
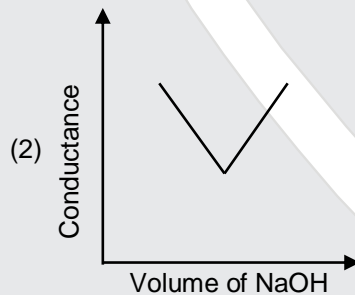
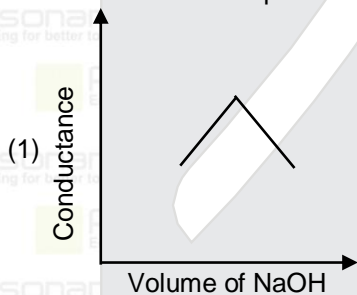
Sol. CFT is used to explain many of the properties of coordination complex like the stability of complex, colour, magnetic properties of the complex and spin of the complex.

While size of splitting (Δ) and the strength of ligand which decide spectro chemical series is explain by ligand field theory which is not explained by crystal field theory.

Given NTA Answer (4)

Reso Answer (2)

38. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide



NTA. (3)

RESO. (3)

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Sol. $C_6H_5COOH + NaOH \rightarrow C_6H_5COONa + H_2O$

- The conductance first drops rapidly due to loss of more conducting H^+ already in the solution.
- However soon, due to common ion effect of $C_6H_5COO^-$, the free H^+ concentration in solution is almost negligible, and then the added NaOH only increase the number of ions by forming more of C_6H_5COONa .
- At the end point, the conductance rises much more rapidly due to addition of OH^- which has higher conductivity.

39. Identify the correct statements about alkali metals.

- A. The order of standard reduction potential ($M^+ | M$) for alkali metal ions is $Na > Rb > Li$
 B. CsI is highly soluble in water
 C. Lithium carbonate is highly stable to heat
 D. Potassium dissolved in concentrated liquid ammonia is blue in colour and paramagnetic.
 E. All the alkali metal hydrides are ionic solids.

Choose the correct answer from the option below.

- (1) C and E only (2) A and E only (3) A, B & D only (4) A, B and E only

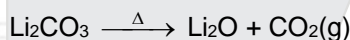
NTA. (2)

RESO. (2)

Sol. (A) $E_{M^+/M}^0$ order of alkali metal ion is $Na > Rb > Li$

(B) CsI is not highly soluble in water

(C) Lithium carbonate decomposes on heating



(D) $K + (x + y) NH_3 \longrightarrow [M(NH_3)_x]^+ + [e^-(NH_3)_y]^-$

In dilute ammonia solution it gives blue colour and paramagnetic in nature but in concentrated ammonia solution it gives copper bronze colour and diamagnetic in nature.

(E) All alkali metal hydrides are ionic in nature.

40. A student has studied the decomposition of a gas AB_3 at $25^\circ C$. He obtained the following data.

p(mm Hg)	50	100	200	400
relative $t_{1/2}(s)$	4	2	1	0.5

The order of the reaction is

- (1) 1 (2) 0.5 (3) 0 (Zero) (4) 2

NTA. (4)

RESO. (4)

Sol. $T_{\frac{1}{2}} \propto (C_0)^{1-n}$

$$\frac{\left(\frac{T_1}{2}\right)_{1st}}{\left(\frac{T_1}{2}\right)_{2nd}} = \left(\frac{P_1}{P_2}\right)^{1-n}$$

$$= \frac{4}{2} = \left(\frac{50}{100}\right)^{1-n} = 2 = \left(\frac{1}{2}\right)^{1-n}$$

$$2 = (2)^{n-1}$$

$$n - 1 = 1 \Rightarrow n = 2$$

$$\text{Order} = 2$$

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41. Match List – I with List– II

List-I Type		List-II Name	
A.	Antifertility drug	I.	Norethindrone
B.	Tranquilizer	II.	Meprobomate
C.	Antihistamine	III.	Seldane
D.	Antibiotic	IV.	Ampicillin

Choose the correct answer from the option below.

(1) A-I, B-III, C-II, D-IV (2) A-II, B-I, C-III, D-I (3) A-IV, B-III, C-II, D-I (4) A-I, B-II, C-III, D-IV

NTA. (4)

RESO. (4)

Sol. NCERT, Chemistry in everyday life

42. Correct statements is :

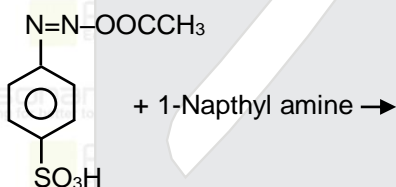
- (1) An average human being consumes equal amount of food and air
- (2) An average human being consumes more food than air
- (3) An average human being consumes nearly 15 times more air than food
- (4) An average human being consumes 100 times more air than food

NTA. (3)

RESO. (3)

Sol. An average human being requires nearly 12-15 times more air than the food. (Ref. NCERT 398).

43. Choose the correct colour of the product for the following



(1) Blue

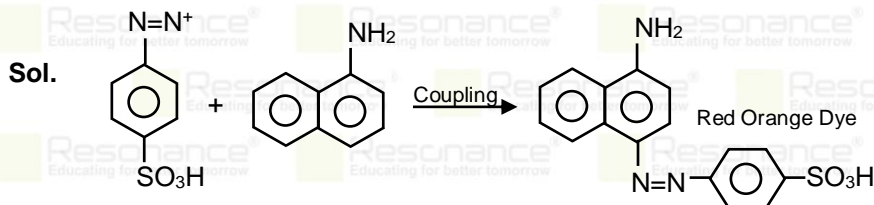
(2) White

(3) Red

(4) Yellow

NTA. (3)

RESO. (3)



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44. Given below two statements

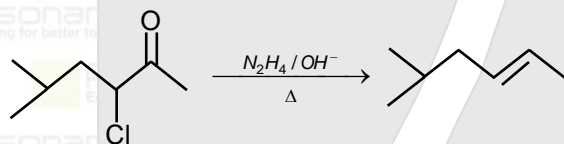
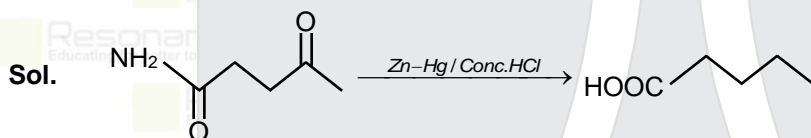


In the light of the above statements, choose the correct answer from the option given below :

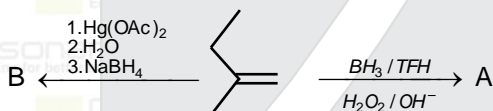
- (1) Statement I is true but Statement II is false (2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true (4) Both Statement I and Statement II are false

NTA. (1)

RESO. (1)



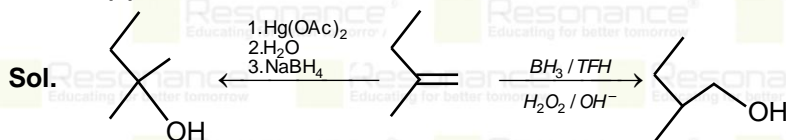
45. Find out the major products from the following reactions.



- (1) A = CC(C)(C)C(O)C B = CC(C)C(O)C (2) A = CC(C)C(O)C B = CC(C)(C)C(O)C
(3) A = CC(C)C(O)C B = CC(C)C(O)C (4) A = CC(C)(C)C(O)C B = CC(C)(C)C(O)C

NTA. (2)

RESO. (2)



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46. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Beryllium has less negative value of reduction potential compared to the other alkaline earth metals.

Reason R : Beryllium has large hydration energy due to small size of Be^{2+} but relatively large value of atomization enthalpy.

In the light of the above statements, choose the most appropriate answer from the option given below.

- (1) Both A and R are correct and R is the correct explanation of A
- (2) A is not correct but R is correct
- (3) Both A and R are correct but R is not the correct explanation of A
- (4) A is correct but R is not correct.

NTA. (1)

RESO. (1)

Sol. Be has least negative SRP value in alkaline earth metal group as it has high hydration enthalpy and high enthalpy of atomisation.

47. The hybridization and magnetic behaviour of cobalt ion in $[\text{Co}(\text{NH}_3)_6]^{3+}$ complex respectively is

- (1) sp^3d^2 and paramagnetic
- (2) d^2sp^3 and paramagnetic
- (3) d^2sp^3 and diamagnetic
- (4) sp^3d^2 and diamagnetic

NTA. (3)

RESO. (3)

Sol. $[\text{Co}(\text{NH}_3)_6]^{3+}$

↓

$\text{Co}^{3+} = 3\text{d}^6 4\text{s}^0 \Rightarrow t_{2g}^{2, 2, 2}, e_g^{0, 0}$

Hybridisation = d^2sp^3

Magnetic moment (μ) = 0, diamagnetic

48. Given below are two statements :

Statements I : Pure Aniline and other arylamines are usually colourless

Statements II : Arylamines get coloured on storage due to atmospheric reduction

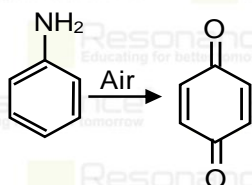
In the light of the above statements, choose the most appropriate answer from the option given below :

- (1) Both Statement I and Statement II are correct
- (2) Statement I is incorrect but Statement II is correct
- (3) Both Statement I and Statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

NTA. (4)

RESO. (4)

Sol. Arylamines get coloured due to atmospheric oxidation.



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49. $K_2Cr_2O_7$ paper acidified with dilute H_2SO_4 turns green when exposed to

- (1) Hydrogen sulphide (2) Sulphur dioxide
(3) Carbon dioxide (4) Sulphur trioxide

NTA. (2)

RESO. (2)

Sol. $Cr_2O_7^{2-} + 2H^+ + 3SO_2 \longrightarrow 2Cr^{3+}$ (green) + $3SO_4^{2-} + H_2O$.

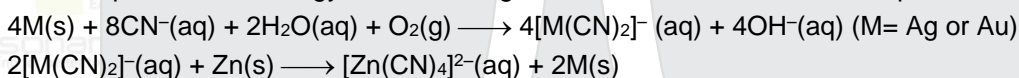
50. The metal which is extracted by oxidation and subsequent reduction from its ore is :

- (1) Al (2) Cu (3) Ag (4) Fe

NTA. (3)

RESO. (3)

Sol. In the metallurgy of **silver** and that of **gold**, the respective metal/ore is leached with a dilute solution of NaCN or KCN in the presence of air (or O_2) from which the metal is obtained later by displacement with zinc scrap. So, in metallurgy of silver and gold first oxidation then reduction process is followed.



51. The number of statement/s which are the characteristics of physisorption is _____

- A. It is highly specific in nature
B. Enthalpy of adsorption is high
C. It decreases with increase in temperature
D. It results into unimolecular layer
E. No activation energy is needed

NTA. 2

RESO. 2

Sol. (A) Physisorption is not depend on nature of Adsorbate. So it is not specific in nature.
(B) In physisorption enthalpy of adsorption is low (20-40 KJ/mol).
(C) Physisorption are decrease with increase in temperature.
(D) Physisorption is multimolecular layered.
(E) In Physisorption activation energy is not required.

52. The total pressure observed by mixing two liquids A and B is 350 mm Hg when their mole fraction are 0.7 and 0.3 respectively.

The total pressure becomes 410 mm Hg if the mole fractions are changed to 0.2 and 0.8 respectively for A and B. The vapour pressure of pure A is _____ mm Hg. (Nearest integer).

Consider the liquids and solutions behave ideally.

NTA. 314

RESO. 314

Sol. $X_A P_A^0 + X_B P_B^0 = P_s$

$$0.7 P_A^0 + 0.3 P_B^0 = 350$$

$$\& 0.2 P_A^0 + 0.8 P_B^0 = 410$$






$$\therefore P_A^0 = 314 \text{ torr.}$$

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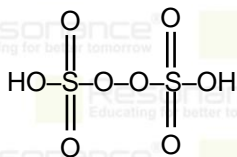
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53. Sum of p-bonds present in peroxodisulphuric acid and pyrosulphuric acid is _____

NTA. 8

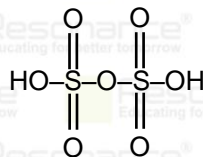
RESO. 8

Sol. (i) Peroxodisulphuric acid [$H_2S_2O_8$]



number of π bond = 4

(ii) Pyrosulphuric acid ($H_2S_2O_7$)



number of π bond = 4

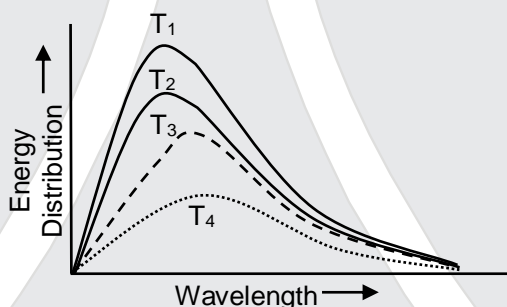
54. The number of units, which are used to express concentration of solutions from the following is _____
Mass percent, mole, mole fraction, molarity, ppm, molality

NTA. 5

RESO. 5

Sol. Mole fraction, molarity, molality, mass % and ppm describes the concentration of solution.

55. Following figure shows spectrum of an ideal body at four different temperature. The number of correct statement/s from the following is _____.



A. $T_4 > T_3 > T_2 > T_1$

B. The black body consists of particles performing simple harmonic motion.

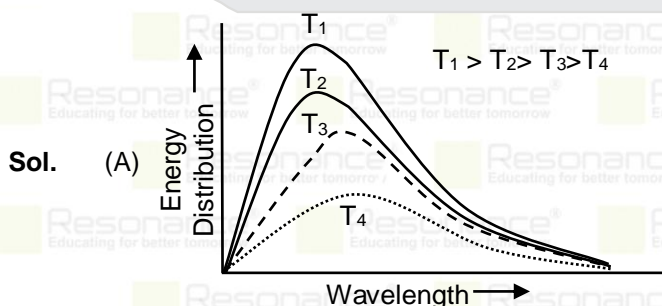
C. The peak of the spectrum shifts to shorter wavelength as temperature increases.

D. $\frac{T_1}{v_1} = \frac{T_2}{v_2} = \frac{T_3}{v_3} \neq \text{constant}$

E. The given spectrum could be explained using quantisation of energy.

NTA. 2

RESO. 2



Wavelength of radiation emitted by black body decreases with increase in temperature.

(C) The peak of spectrum shift to shorter wavelength as temperature increases.

(E) Given spectrum could be explained by quantization.

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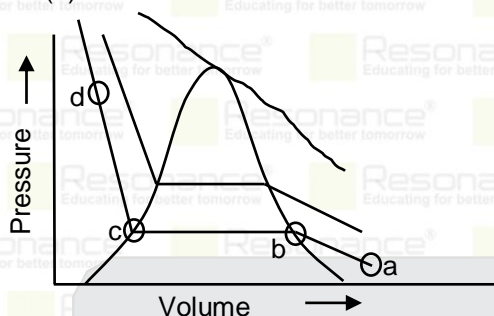
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56. The number of statement/s, which are correct with respect to the compression of carbon dioxide from point (a) in the Andrews isotherm from the following is _____



- A. Carbon dioxide remains as a gas upto point (b)
 B. Liquid carbon dioxide appears at point (c)
 C. Liquid and gaseous carbon dioxide coexist between points (b) and (c)
 D. As the volume decreases from (b) to (c), the amount of liquid decreases.

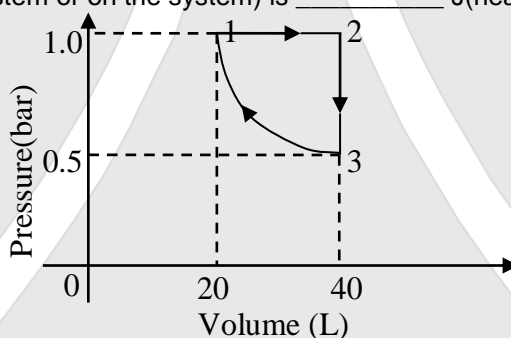
NTA. 2

RESO. 2

Sol.

- A. Up to point b carbon dioxide remains gas.
 C. Liquid and gaseous carbon dioxide coexists between point (b) and (c).

57. One mole of an ideal monoatomic gas is subjected to change as shown in the graph. The magnitude of the work done (by the system or on the system) is _____ J (nearest integer)



Given $\log 2 = 0.3$
 $\ln 10 = 2.3$

NTA. 620

RESO. 620

Sol.

$$W_{1 \rightarrow 2} = -1 (40 - 20) = -20 \text{ bar lit.}$$

$$W_{2 \rightarrow 3} = 0$$

$$W_{3 \rightarrow 1} = -nRT \ln \left(\frac{V_2}{V_1} \right)$$

$$= -P_1 V_1 \ln \left(\frac{V_2}{V_1} \right)$$

$$= -1 \times 20 \ln \frac{20}{40}$$

$$= 20 \ln 2$$

$$= 20 \times 2.3 \times 0.3 = 13.8 \text{ bar lit.}$$

$$W_{\text{total}} = -20 + 13.8$$

$$= -6.2 \text{ bar lit.}$$

$$(1 \text{ bar lit.} = 100 \text{ J})$$

$$W_{\text{total}} = -6.2 \times 100 = -620 \text{ J}$$

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58. Maximum number of isomeric monochloro derivatives which can be obtained from 2, 2, 5, 5-tetramethylhexane by chlorination is _____.

NTA. 3

RESO. 3

Sol.



Total = 3

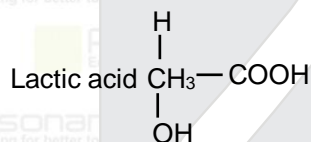
59. Total number of tripeptides possible by mixing of valine and proline is _____.

NTA. 8

RESO. 8

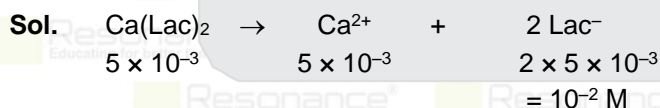
Sol. Pro-Val-Pro
Pro-Val-Val
Val-Pro-Pro
Val-Pro-Val
Val-Val-Pro
Pro-Pro-Val
Val-Val-Val
Pro-Pro-Pro

60. If the pKa of lactic acid is 5, then the pH of 0.005 M calcium lactate solution at 25°C is _____ × 10⁻¹ (Nearest integer).



NTA. 85

RESO. 85



Calcium lactate is a weak acid and strong base salt so

$$\text{pH} = 7 + \frac{1}{2} \text{pKa} + \frac{1}{2} \log C$$

$$= 7 + \frac{1}{2} \times 5 + \frac{1}{2} \log 10^{-2}$$

$$= 7 + 2.5 - 1$$

$$= 6 + 2.5$$

$$= 8.5$$

$$= 85 \times 10^{-1}$$

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