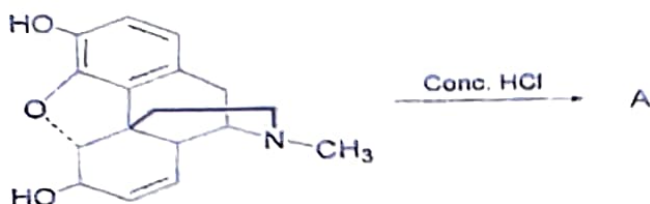


1. How will you establish that palavering contains a methylene group?
2. What happens when flavones are hydrolyzed with alcoholic KOH? How are hydrolysis products helpful in structure determination of flavones?
3. How will you show that geraniol contains a $-\text{CH}_2\text{OH}$ group?
4. What is product A in following reaction? Give its mechanism.



5. What happens when lactose is oxidized with bromine water? How will you predict that C-4 of glucose is linked to C-1 of galactose in lactose molecule?
6. How is Mevalonic acid biosynthesized from acetyl-CoA?

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.



खण्ड-ब (बहुविकल्पीय)
Section-B (Objective)
CHE 510

M.Sc. IInd SEMESTER EXAMINATION, 2022
CHEMISTRY
(Natural Products)
Credit (4+0)
(CBCS Mode)

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Date(तिथि) : _____

पुस्तिका सीरीज
Booklet Series

C

Paper ID

(To be filled in the
OMR Sheet)

5240

अनुक्रमांक (अंकों में) :

Roll No. (In Figures)

अनुक्रमांक (शब्दों में) :

Roll No. (In Words) :

Time : 1½ Hrs.

समय : 1½ घण्टे

Max. Marks : 60

अधिकतम अंक : 60

नोट : पुस्तिका में 40 प्रश्न दिये गये हैं, सभी प्रश्न करने होंगे। प्रत्येक प्रश्न 1.5 अंक का होगा।

Important Instructions :

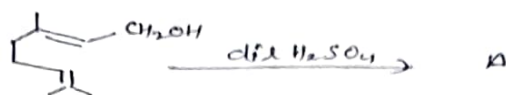
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महत्वपूर्ण निर्देश :

1. अभ्यर्थी अपने अनुक्रमांक केवल उन्हीं स्थानों पर लिखेंगे जो इसके लिए दिये गये हैं, अर्थात् प्रश्न पुस्तिका के मुख्य पृष्ठ तथा साथ दिये गये ओ०एम०आर० उत्तर पत्र पर, तथा अन्यत्र कहीं नहीं लिखेंगे।
2. प्रश्न पुस्तिका मिलते ही अभ्यर्थी को जाँच करके सुनिश्चित कर लेना चाहिए कि इस पुस्तिका में पूरे पृष्ठ हैं और कोई प्रश्न छूटा तो नहीं है। यदि कोई विसंगति है तो प्रश्न पुस्तिका मिलने के 10 मिनट के भीतर ही कक्ष परिप्रेक्षक को सूचित करना चाहिए और बिना वृत्ति की दूसरी प्रश्न पुस्तिका प्राप्त कर लेना चाहिए।

1. Which of the following alkaloid is not present in cinchona bark ?
 - (A) Quinidine
 - (B) Quinine
 - (C) Quinoline
 - (D) Cinchonine
2. Who first coined the name alkaloids :
 - (A) S. W. Pelletier
 - (B) Friedrich Serturner
 - (C) Emil Fischer
 - (D) Robert Woodward
3. A reducing sugar :
 - (A) Has fewer calories
 - (B) Is always a ketone
 - (C) Reacts with Fehling's reagent
 - (D) Not reacts with Fehling's reagent
4. Principle Sugar in blood is :
 - (A) Fructose
 - (B) Glucose
 - (C) Sucrose
 - (D) Galactose

5. Give product A :



(A)



(B)



(C)



(D)



6. The fundamental unit in Terpenes/Terpenoids is :

(A) 1, 3- butadiene

(B) Allene

(C) 2- methyl – 1, 3 butadiene

(D) None of the above

7. Which is a Monosaccharide:

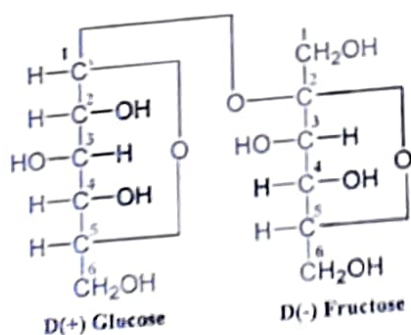
(A) Sucrose

(B) Maltose

(C) Galactose

(D) Cellulose

8. Biosynthesis of squalene may be explained by:
- (A) Mevalonic acid pathway
 - (B) SIKIMIC acid pathway
 - (C) Krebs cycle
 - (D) Poly β - ketoacid pathway
9. Enzymatic biosynthesis of cholesterol was given by:
- (A) K. E. Bloch
 - (B) Robinson
 - (C) Kostenecky
 - (D) P. Koch
10. Following is structure of:

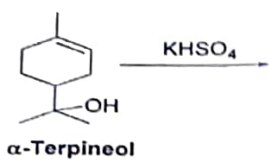


- (A) Lactose
- (B) Maltose
- (C) Cellulose
- (D) Sucrose

11. Lactose on hydrolysis mainly gives:

- (A) Fructose and Glucose
- (B) Galactose and Glucose
- (C) Glucose Only
- (D) Fructose Only

12. 'A' in following reaction is:

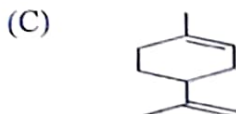
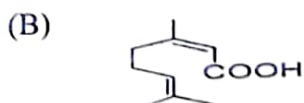
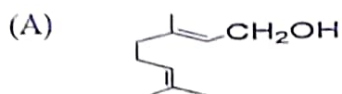
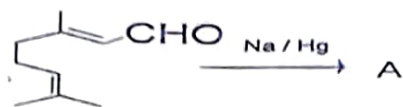


- (A) Citral
- (B) Limonene
- (C) Geraniol
- (D) Camphor

13. Structure of p-Cymene is:

- (A)
- (B)
- (C)
- (D)

14. In the following reaction "A" is:



(D) None of the above

15. Monoterpenoid contains isoprene unit:

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

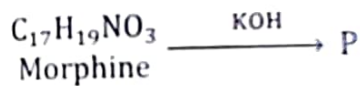
16. Cyanidin in acidic medium shows following colour:

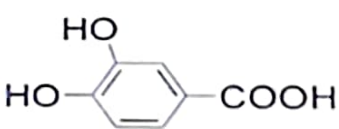
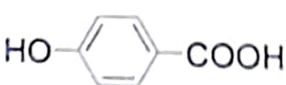
- (A) Violet
- (B) Blue
- (C) Red
- (D) Yellow

17. Red rose contains following anthocyanin:

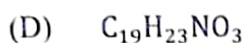
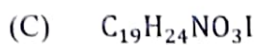
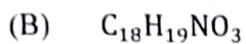
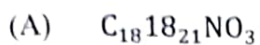
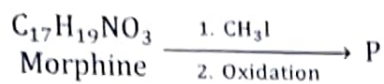
- (A) Cyanidin
- (B) Pelargonidin
- (C) Delphinidin
- (D) Peonidin

18. Pelargonidin is:
- (A) 3,4',5,7- tetrahydroxy flavylum chloride
 - (B) 3,3'4',5,7 – pentahydroxy flavylum chloride
 - (C) 3,3'4',5,5'7 – hexahydroxy flavylum chloride
 - (D) 3,4',5,7 – tetrahydroxy -3'-methoxy flavylum chloride
19. Parent compound in anthocyanin is:
- (A) Flavylum chloride
 - (B) 2-Phenyl-4- chromone
 - (C) 3-Phenyl chromone
 - (D) Chromone
20. In the following reaction "P" is:

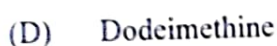
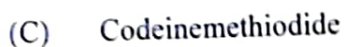
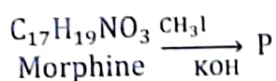


- (A) 
- (B) 
- (C) 
- (D) 

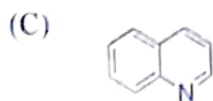
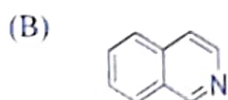
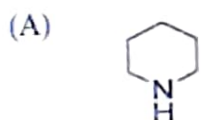
21. In the following reaction "P" is:



22. In the following reaction "P" is:



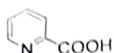
23. Papaverine contains following in its structure:



24. In the following reaction "A" is:



(A)



(B)



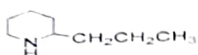
(C)



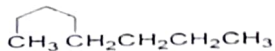
(D)



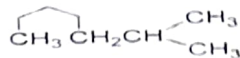
25. In the following reaction "A" is:



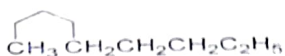
(A)



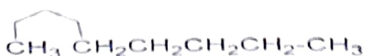
(B)



(C)

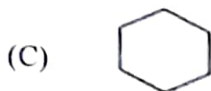
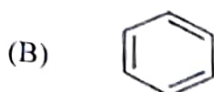
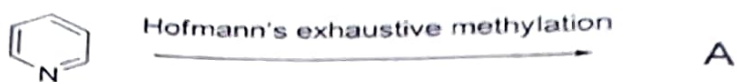


(D)



26. Greek philosopher Socrate was found dead after taking extract of:
- (A) Coniine
 - (B) Nicotine
 - (C) Morphine
 - (D) Quinine
27. Botanical name of opium is:
- (A) Conium maculatum
 - (B) Papaver somniferum
 - (C) Nicotiana tobacum
 - (D) Rauwolfia serpentina
28. In the absence of β -hydrogen following method is used for determination of cyclic nature of nitrogen:
- (A) Herzig-Meyer
 - (B) Emde
 - (C) Hofmann
 - (D) Ziesel

29. In the following reaction final product "A" is:



30. The presence of N-methyl groups and their number may be confirmed by means of:

(A) Herzig-Meyer method

(B) Ziesel method

(C) Bragmann method

(D) Emde method

31. Liquid alkaloid is:

(A) Morphine

(B) Nicotine

(C) Reserpine

(D) Quinine

32. Following is volatile:
- (A) Coniine
 - (B) Papaverine
 - (C) Morphine
 - (D) Quinine
33. Phenanthrene skeleton is present in:
- (A) Papavrine
 - (B) Nicotine
 - (C) Morphine
 - (D) Coniine
34. Number of methoxy group in papaverine are:
- (A) One
 - (B) Two
 - (C) Three
 - (D) Four
35. Ziesel test is used for identification of:
- (A) Methylene group
 - (B) Methoxy group
 - (C) Carbonyl group
 - (D) Carboxyl group
36. Flavonol is:
- (A) 6 - hydroxy flavone
 - (B) 7 - hydroxy flavone
 - (C) 3 - hydroxy flavone
 - (D) 5 - hydroxy flavone

37. Chrysin is:
- (A) 5, 6 – dihydroxy flavone
 - (B) 5, 7 - dihydroxy flavone
 - (C) 6, 7 - dihydroxy flavone
 - (D) 3, 5 - dihydroxy flavone
38. Diacetyl derivative of morphine is:
- (A) Papaverine
 - (B) Thebaine
 - (C) Heroin
 - (D) Codeine
39. Which is not characteristic feature of alkaloid?
- (A) Complex molecular structure and nitrogen in the molecule
 - (B) Biosynthetically derived
 - (C) Basic in nature
 - (D) Acidic in nature only
40. Flavones on treatment with conc. HCl Produce brilliant color compound, which indicate the presence of:
- (A) α - Pyrone system
 - (B) Primary amine
 - (C) β - Pyrone
 - (D) γ - Pyrone ring

1. What are the facts important for stabilisation of higher coordination number ?
2. Discuss the different mechanism for explaining the molecular rearrangement.
3. Give a detailed account of complimentary and non complimentary reaction with suitable examples.
4. Explain the factors affecting the rates of direct electron transfer reaction.
5. Describe dissociative and associative mechanism of substitution reactions in octahedral complexes.
6. What is the basic difference between thermodynamic and kinetic stability constants?
Explain the role of central metal ions in determining the stability constant of metal complexes.

खण्ड-ब (बहुविकल्पीय)

Section-B (Objective)

CHE 509

M.Sc. IInd SEMESTER EXAMINATION, 2022

Chemistry

(Transition Elements)

(Credit 4+0)

(CBCS Mode)

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Date(तिथि) : _____

पुस्तिका सीरीज
Booklet Series

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Paper ID

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5198

अनुक्रमांक (अंकों में) :

Roll No. (In Figures)

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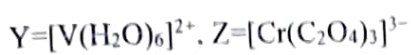
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1. Designate the following complexes X, Y and Z as inert or labile $X=[Al(C_2O_4)_3]^{3-}$,



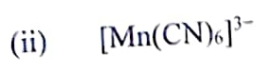
(A) X and Y are inert ; Z is labile

(B) X and Y are labile ; Y is inert

(C) X is inert ; Y and Z are labile

(D) X is labile ; Y and Z are inert

2. The rate of exchange of cyanide ligands in the complexes-



(iii) $[Cr(CN)_6]^{3-}$ by ^{14}CN follow the:

(A) (ii) > (i) > (iii)

(B) (iii) > (i) > (ii)

(C) (i) > (iii) > (ii)

(D) (i) > (ii) > (iii)

3. Cis and trans complexes of the type $[PtA_2X_2]$ are distinguished by:

(A) Chromyl chloride test

(B) Carbylamine test

(C) Kurnakov test

(D) Ring test

4. The number of possible isomers of $[Ru(PPh_3)_2(acac)_2]$ (acac = acetylacetonate) is:

(A) 2

(B) 3

(C) 4

(D) 5

5. The chromium (III) species formed soon after electron transfer between $[\text{IrCl}_6]^{2-}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is:
- (A) $\text{Cr}(\text{H}_2\text{O})_6^{3+}$
 - (B) $\text{Cr}(\text{H}_2\text{O})_5^{2+}$
 - (C) CrCl_6^{3-}
 - (D) $\text{Cr}(\text{H}_2\text{O})_3\text{Cl}_3$
6. The mechanism of the reaction between $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{bpy})_3]^{3+}$ (bpy=2,2'-bipyridine) is)
- (A) Outer-sphere electron transfer
 - (B) Inner -sphere electron transfer
 - (C) Self-exchange reaction
 - (D) Legrand- exchange followed by electron transfer
7. Coordinate water molecules of Cd (II) complex can be successively replaced by Br^- finally to result $[\text{Cd Br}_4]^{2-}$; in this process, the fourth equilibrium constant is observed to be higher than the third one, because:
- (A) Equilibrium constant for the last step is always the highest
 - (B) Three molecules of H_2O are released during the fourth step
 - (C) The aqua - Cd (II) species is octahedral
 - (D) An anion (Br^-) replaces a neutral (H_2O) molecule from coordination sphere
8. The possible geometries for complexes with co-ordinate number 7
- (A) Pentagonal bi pyramidal
 - (B) Capped octahedron
 - (C) Capped trigonal prism
 - (D) All of the above

9. Marcus-Hush theory applies to :
- Any electron transfer reaction
 - Outer sphere electron transfer
 - Inner sphere electron transfer
 - All biological redox reactions
10. How are the stepwise stability constants (K) related to the overall stability constant (β) ?
- $\beta_n = K_1 + K_2 + \dots + K_n$
 - $\beta_n = K_1 \times K_2 \times \dots \times K_n$
 - $\beta_n = \log K_1 + \log K_2 + \dots + \log K_n$
 - $\beta_n = 1/(K_1 + K_2 + \dots + K_n)$
11. The existence of two different coloured complexes of $[Co^{2+}(NH_3)_4Cl_2]$ is due to
- Geometrical isomerism
 - Linkage isomerism
 - Optical isomerism
 - Coordination isomerism
12. The octahedral complex having the following equilibrium constant :
- | K_1 | K_2 | K_3 | K_4 | K_5 | K_6 |
|-----------|--------|-----------|-----------|-----------|-----------|
| 10^{12} | 10^3 | 10^{-3} | 10^{-2} | 10^{-4} | 10^{-4} |
- What is the value of K_{stable} ?
- 10^{12}
 - 10^{-2}
 - 10^5
 - 10^{-5}
13. Marcus and Hush derived the relationship :
- $k_{12} = [k_{11} k_{22} K_{12} f]^{1/2}$
 - $k_{12} = k_{11} + K_{22}$
 - $K_{12} = \frac{k_{11}}{k_{22}}$
 - $k_{12} = [k_{11} k_{22} K_{12} f]^2$

14. Which of the following compounds has a meridional isomer ?
- $[\text{Fe}(\text{NO})_5\text{Br}]^+$
 - $[\text{Al}(\text{CO})_3(\text{NO}_2)_3]$
 - $[\text{K}(\text{NH}_3)_4(\text{NO})_2]^+$
 - $[\text{Fe}(\text{H}_2\text{O})_2(\text{Co})_2(\text{NO})_2]^{3+}$
15. The CORRECT order of the trans effect is :
- $\text{CN} > \text{NO}_2 > \text{Cl} > \text{NH}_3$
 - $\text{NH}_3 > \text{NO}_2 > \text{CN} > \text{Cl}^-$
 - $\text{NO}_2 > \text{Cl} > \text{CN} > \text{NH}_3$
 - $\text{Cl} > \text{NO}_2 > \text{CN} > \text{NH}_3$
16. The CORRECT order of the rate of exchange of water molecules between the coordination sphere and the bulk is :
- $\text{Cr}^{3+} < \text{Al}^{3+} < \text{Cr}^{2+} < \text{Ni}^{2+}$
 - $\text{Cr}^{3+} < \text{Al}^{3+} < \text{Ni}^{2+} < \text{Cr}^{2+}$
 - $\text{Cr}^{3+} < \text{Ni}^{2+} < \text{Cr}^{2+} < \text{Al}^{3+}$
 - $\text{Cr}^{3+} < \text{Cr}^{2+} < \text{Al}^{3+} < \text{Ni}^{2+}$
17. Consider the following pairs of complexes-
- $[\text{CoF}(\text{NH}_3)_5]^{2+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$;
 $[\text{Co}(\text{NH}_3)_5(\text{OH}_2)]^{3+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$;
 $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$;
 $[\text{CoI}(\text{NH}_3)_5]^{2+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$
- The electron transfer rate will be fastest in the pair :
- $[\text{CoF}(\text{NH}_3)_5]^{2+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$
 - $[\text{Co}(\text{NH}_3)_5(\text{OH}_2)]^{3+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$
 - $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$
 - $[\text{CoI}(\text{NH}_3)_5]^{2+}$ and $[\text{Cr}(\text{OH}_2)_6]^{2+}$

18. The rate of exchange of OH_2 present in the coordination sphere by $^{18}\text{OH}_2$ of -
- $[\text{Cu}(\text{OH}_2)_6]^{2+}$
 - $[\text{Mn}(\text{OH}_2)_6]^{2+}$
 - $[\text{Fe}(\text{OH}_2)_6]^{2+}$
 - $[\text{Ni}(\text{OH}_2)_6]^{2+}$
- follows an order :
- $(i) > (ii) > (iii) > (iv)$
 - $(i) > (iv) > (iii) > (ii)$
 - $(ii) > (iii) > (iv) > (i)$
 - $(iii) > (i) > (iv) > (ii)$
19. The substitution reaction of $[\text{Co}(\text{CN})_5\text{Cl}]^{3-}$ with OH^- to give $[\text{Co}(\text{CN})_5\text{OH}]^{3-}$ in comparison to that $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ to give $[\text{Co}(\text{CN})_5\text{Cl}]^{2+}$ is :
- Slow and the rate depends on $[\text{Co}(\text{CN})_5\text{Cl}]^{3-}$
 - Fast and the rate depend only on $[\text{Co}(\text{CN})_5\text{Cl}]^{3-}$
 - Slow and the rate depends on $[\text{Co}(\text{CN})_5\text{Cl}]^{3-}$ and OH^-
 - Fast and the rate depends on $[\text{Co}(\text{CN})_5\text{Cl}]^{3-}$ and OH^-
20. In the inner sphere reduction of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ with $[\text{Cr}(\text{OH}_2)_6]^{2+}$, the chloride:
- Bridges the metal centers only
 - Mediates electron transfer only
 - Bridges and mediates electron transfer both
 - Does not play any role
21. The acid catalyzed hydrolysis of trans - $[\text{Co}(\text{en})_2\text{AX}]^{n+}$ can give cis-product also due to the formation of :
- Square pyramidal intermediate
 - Trigonal bi pyramidal intermediate
 - Pentagonal bipyramidal intermediate
 - Face capped octahedral intermediate

22. Reaction of $[\text{CoCl}(\text{NH}_3)_5]^{2+}$ by Cr^{2+} (aq.) leads to the formation $[\text{CrCl}(\text{H}_2\text{O})_5]^{2+}$. This is an example of :
- Outer - sphere redox reaction
 - Inner-sphere redox reaction
 - Acid hydrolysis reactions
 - Base hydrolysis reaction
23. Reaction of $[\text{CoCl}(\text{NH}_3)_5]^{2+} + \text{OH}^-$ giving $[\text{Co}(\text{OH})(\text{NH}_3)_5]^{2+}$ follows a mechanistic pathway which is
- $\text{S}_{\text{N}}1$
 - $\text{S}_{\text{N}}2$
 - $\text{S}_{\text{N}}1\text{CB}$
 - $\text{S}_{\text{E}}2$
24. Electron transfer from $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ to $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is likely to occur via :
- d-d transition
 - Inner sphere electron transfer
 - $\text{S}_{\text{N}}1$ mechanism
 - Outer sphere electron transfer
25. Find mechanisms that are used to explain the isomerisation of the octahedral complexes with chelating ligands :
- The berry pseudo rotation mechanism
 - The bailor twist and Ray-Dutt twist.
 - The Thompson mechanism
 - None of the above
26. In the following reaction $[\text{PtCl}_4]^{2-} + \text{NO}_2^- \rightarrow \text{A} \xrightarrow{\text{NH}_3} \text{B}$
- trans - $[\text{PtCl}_2(\text{NO}_2)(\text{NH}_3)]^-$
 - cis - $[\text{PtCl}_2(\text{NO}_2)(\text{NH}_3)]^-$
 - trans - $[\text{PtCl}_2(\text{NH}_3)_2]$
 - cis - $[\text{PtCl}_2(\text{NO}_2)_2]^{2-}$

27. Which one of the following compounds has optical isomers ?

- (A) Trans $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- (B) $[\text{PtCl}_2(\text{NH}_3)_2]$
- (C) $[\text{Co}(\text{en})_3]^{3+}$
- (D) $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2]$

28. Identify X in the reaction $[\text{Pt}(\text{NH}_3)_4]^{2+} + 2\text{HCl} \rightarrow \text{X}$

- (A) cis $[\text{PtCl}_2(\text{NH}_3)_2]$
- (B) trans $[\text{PtCl}_2(\text{NH}_3)_2]$
- (C) $[\text{PtCl}(\text{NH}_3)_3]^+$
- (D) $[\text{PtCl}_3(\text{NH}_3)]^-$

29. The octahedral complex / complex ion which shows both facial and meridional isomers is.

- (A) Trithyacinato cobalt (III)
- (B) Tris (ethylene diamine cobalt (III))
- (C) Dichlorodiglycinato cobalt (III)
- (D) Trioxalato cobalt ate(III)

30. The possible number of geometrical isomers of the type $[\text{M a b c d e f}]^{n+}$ type complexes are:

- (A) 30
- (B) 15
- (C) 20
- (D) 10

31. The number of possible isomers for $[\text{Ru}(\text{bpy})_2\text{Cl}_2]$ is (bpy = 2,2' bipyridine)

- (A) 2
- (B) 3
- (C) 4
- (D) 5

32. The pair of ions that most commonly forms with coordination number 2 is :
- (A) Cd (II) and Hg (II)
 - (B) Cu (II) and Hg (I)
 - (C) Cd (I) and Hg (I)
 - (D) Cu (I) and Hg (II)
33. The geometries corresponding to coordination number 3 are.
- (A) Trigonal Planar
 - (B) Trigonal Pyramidal
 - (C) T- shaped
 - (D) Both (A) and (B)
34. The reaction where bonds are neither made nor broken is.
- (A) Inner sphere electron transfer reaction
 - (B) Outer sphere electron transfer reaction
 - (C) Both (A) and (B)
 - (D) None of these
35. Irving-William order of stability is related with .
- (A) Radius ratio concept
 - (B) Charge - to radius -ratio concept
 - (C) Both (A) and (B)
 - (D) None of these
36. Bjerrum's method is used to determine the stability constant of the metal complex by change in :
- (A) p^H of the solution
 - (B) Concentration of the solution
 - (C) Optical activity
 - (D) None of these

37. In Job's method, the stability constant of the complex compound is determined by the change in :
- (A) Concentration
 - (B) Absorbance
 - (C) Both (A) and (B)
 - (D) None of these
38. The radius-ratio for cubic system ranges:
- (A) 0.732 to 1.00
 - (B) 0.155 to 0.225
 - (C) 0.414 to 0.732
 - (D) None of these
39. The substitutionally inert complex ion amongst the following is :
- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
 - (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 - (C) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
 - (D) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
40. The existence of two different colored complexes of $\text{Co}(\text{NH}_3)_4\text{Cl}_2$ is due to :
- (A) Optical isomerism
 - (B) Linkage isomerism
 - (C) Geometrical isomerism
 - (D) Coordination isomerism

1. Discuss stern model of electrical double layer.
2. Discuss variation of fugacity with pressure.
3. Explain Debye-Falkenhagen effect.
4. Discuss dropping mercury electrode (DME).
5. Explain Nernst-Heat theorem.
6. Discuss over-voltage and its application.



खण्ड-ब (बहुविकल्पीय)
Section-B (Objective)
CHE 508

M.Sc. IInd SEMESTER EXAMINATION, 2022
CHEMISTRY

(Thermodynamics and Electrochemistry)

Credit (4+0)
(CBCS Mode)

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Paper ID

(To be filled in the
OMR Sheet)

Date (तिथि) : _____

5145

अनुक्रमांक (अंकों में) :

Roll No. (In Figures) :

अनुक्रमांक (शब्दों में) :

Roll No. (In Words) :

Time : 1½ Hrs.

समय : 1½ घण्टे

Max. Marks : 60

अधिकतम अंक : 60

नोट : पुस्तिका में 40 प्रश्न दिये गये हैं, सभी प्रश्न करने होंगे। प्रत्येक प्रश्न 1.5 अंक का होगा।

Important Instructions :

1. The candidate will write his/her Roll Number only at the places provided for, i.e. on the cover page and on the OMR answer sheet at the end and nowhere else.
2. Immediately on receipt of the question booklet, the candidate should check up the booklet and ensure that it contains all the pages and that no question is missing. If the candidate finds any discrepancy in the question booklet, he/she should report the invigilator within 10 minutes of the issue of this booklet and a fresh question booklet without any discrepancy be obtained.

महत्वपूर्ण निर्देश :

1. अभ्यर्थी अपने अनुक्रमांक केवल उन्हीं स्थानों पर लिखेंगे जो इसके लिए दिये गये हैं, अर्थात् प्रश्न पुस्तिका के मुख्य पृष्ठ तथा साथ दिये गये ओ.एम.आर. उत्तर पत्र पर तथा अन्यत्र कहीं नहीं लिखेंगे।
2. प्रश्न पुस्तिका मिलते ही अभ्यर्थी को जाँच करके सुनिश्चित कर लेना चाहिए कि इस पुस्तिका में पूरे पृष्ठ हैं और कोई प्रश्न छूटा तो नहीं है। यदि कोई विसंगति है तो प्रश्न पुस्तिका मिलने के 10 मिनट के भीतर ही कक्ष परिप्रेक्षक को सूचित करना चाहिए और बिना झुटि की दूसरी प्रश्न पुस्तिका प्राप्त कर लेना चाहिए।

1. Dropping Mercury Electrode (DME) is used in :
 - (A) Conductimetry
 - (B) Potentiometry
 - (C) Polarography
 - (D) None of the above
2. In which of the following relation $\left(\frac{\partial P}{\partial T}\right)_V$ equals to :
 - (A) $\left(\frac{\partial S}{\partial V}\right)_T$
 - (B) $\left(\frac{\partial V}{\partial S}\right)_T$
 - (C) $\left(\frac{\partial T}{\partial S}\right)_V$
 - (D) $\left(\frac{\partial S}{\partial T}\right)_P$
3. In the representation of cell, the electrode on the right side is written in the order:
 - (A) Ion, electrode
 - (B) Electrode, ion
 - (C) Both (A) and (B)
 - (D) None of the above
4. The third law of thermodynamics states that :
 - (A) If object A is in thermal equilibrium with object B, and object B is in thermal equilibrium with object C, then object A is in thermal equilibrium with object C
 - (B) The entropy of the universe increases for reversible processes
 - (C) $\Delta S = 0$ for a pure element in its most stable state at standard conditions
 - (D) $S = 0$ for a perfect crystal of a pure substance at 0K

5. In which of the followings is not the correct equation ?

(A) $H = E + PV$

(B) $A = H - TS$

(C) $dE = TdS - PdV$

(D) $H = G + TS$

6. The partial molar volume of component 1 in the mixture of 2 component system is :

(A) $V_{1,m} = (\partial V / \partial n_2)_{T,P,n_1}$

(B) $V_{1,m} = (\partial V / \partial n_1)_{T,P,n_1}$

(C) $V_{1,m} = (\partial V / \partial n_1)_{T,P,n_2}$

(D) $V_{1,m} = (\partial V / \partial n_2)_{T,P,n_2}$

7. Entropy is an :

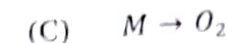
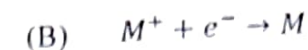
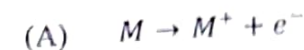
(A) Intensive property

(B) Extensive property

(C) Colligative property

(D) None of the above

8. If the metal M is made the cathode in electrochemical cell, then the reaction will be :



(D) None

9. Joule Thomson effect is based upon _____?
- (A) Sudden compression of gases
 - (B) Sudden expansion of gases
 - (C) Cooling of gases
 - (D) Heating of gases
10. Correct Gibbs-Duhem equation is written as :
- (A) $-SdT + VdP - \sum n_i d\mu_i = 0$
 - (B) $-SdT + VdP - \sum n_i d\mu_i = 1$
 - (C) $-SdT - VdP + \sum n_i d\mu_i = 0$
 - (D) $-SdT - VdP + \sum n_i d\mu_i = 1$
11. If s orientations are possible for a molecule the molar residual entropy will be :
- (A) $S_m = R \ln K$
 - (B) $S_m = R \ln K^2$
 - (C) $S_m = R \ln s^2$
12. Which of the following laws was formulated by Nernst ?
- (A) First law of thermodynamics
 - (B) Second law of thermodynamics
 - (C) Third law of thermodynamics
 - (D) Zero law of thermodynamics

13. In one of the Maxwell's relations $\left(\frac{\partial T}{\partial V}\right)_S$ equals to :

(A) $-\left(\frac{\partial P}{\partial S}\right)_V$

(B) $-\left(\frac{\partial V}{\partial S}\right)_P$

(C) $\left(\frac{\partial P}{\partial T}\right)_V$

(D) $-\left(\frac{\partial V}{\partial T}\right)_P$

14. The absolute entropy of the substance at temperature T can be calculated by :

(A) $\dot{S}(T) = \int_0^T \frac{C_P}{T} dT$

(B) $\dot{S}(T) = \int_0^T \frac{C_V}{T} dT$

(C) $\dot{S}(T) = \int_0^T \frac{T^2}{C_V} dT$

(D) $\dot{S}(T) = \int_0^T \frac{T^2}{C_P} dT$

15. Mathematically the Nernst Heat theorem may be expressed as :

(A) $\lim_{T \rightarrow 0} \left[\partial(\Delta T) / \partial G \right]_P = 0$

(B) $\lim_{T \rightarrow 0} \left[\partial(\Delta H / \Delta G) \right]_T = 0$

(C) $\lim_{T \rightarrow 0} \left[\partial(\Delta G / \partial T) \right]_P = 0$

(D) $\lim_{T \rightarrow 0} \left[\partial(\Delta G / \Delta H) \right]_T = 0$

16. In DME the calomel electrode is used as :

- (A) Cathode
- (B) Anode
- (C) Supporting electrode
- (D) None of the above

17. Which of the following is residual entropy of substance ?

- (A) Entropy of perfect solid equal to 0 at $T = 0$
- (B) Entropy of solid equal to 0 at $T = 273\text{ K}$
- (C) Entropy of perfect solid greater than zero at $T = 273\text{ K}$
- (D) Entropy of solid greater than 0 at $T = 0\text{ K}$

18. In one of the Maxwell's relations $\left(\frac{\partial S}{\partial P}\right)_T$ equals to :

- (A) $\left(\frac{\partial V}{\partial T}\right)_P$
- (B) $-\left(\frac{\partial V}{\partial T}\right)_P$
- (C) $\left(\frac{\partial P}{\partial T}\right)_V$
- (D) $-\left(\frac{\partial T}{\partial V}\right)_S$

19. If Q_M and Q_{OHP} are respectively the excess charge density, Q_M on metal and excess charge density on OHP, Q_{OHP} , then which is correct in the case of Helmholtz-Perrin theory :

- (A) $Q_{OHP} < Q_M$
- (B) $Q_{OHP} > Q_M$
- (C) $Q_{OHP} = -Q_M$
- (D) None of these

20. The correct Clapeyron equation is :

(A) $\frac{dP}{dT} = \frac{\Delta V_m}{T\Delta H_m}$

(B) $\frac{dP}{dT} = \frac{T\Delta V_m}{\Delta H_m}$

(C) $\frac{dP}{dT} = \frac{\Delta H_m}{T\Delta V_m}$

(D) $\frac{dP}{dT} = \frac{\Delta H_m}{\Delta V_m}$

21. Suppose the metal is made the anode and potential applied is slightly greater than the reversible potential then :

(A) There will be increase in the concentration of ions

(B) There will be no change

(C) There will be fall in concentration of ions

(D) None of the above

22. Joule Thomson coefficient for an ideal gas is :

(A) Higher than zero

(B) Less than zero

(C) Zero

(D) One

23. Which of the following models of electrical double layers is known as diffuse double layer theory ?

(A) Helmholtz-Perrin model

(B) Stern model

(C) Gouy-Chapman model

(D) None of these

24. If C_H and C_G respectively are the Helmholtz-Perrin capacity and Gouy-Chapman capacity, then stern model suggests that the total differential capacity, C of the interface is given by :
- (A) $C = C_H + C_G$
- (B) $C = \frac{1}{C_H} + \frac{1}{C_G}$
- (C) $\frac{1}{C} = \frac{1}{C_H} + \frac{1}{C_G}$
- (D) $\frac{1}{C} = C_H + C_G$
25. The increase in the conductivity of an electrolyte solution when the applied voltage has a very high frequency is known as :
- (A) Wein effect
- (B) Debye-Huckel-Onsagar theory
- (C) Debye-Falkenhagen effect
- (D) Ostwald's dilution law
26. Which in the following equations explains the variation of fugacity with temperature at constant pressure ?
- (A) $\left(\frac{\partial \ln f}{\partial T}\right)_p = \frac{H_0 - H}{RT}$
- (B) $\left(\frac{\partial \ln f}{\partial T}\right)_p = \frac{H_0 - H}{RT^2}$
- (C) $\left(\frac{\partial \ln f}{\partial T}\right)_p = \frac{H - H_0}{T^2}$
- (D) $\left(\frac{\partial \ln f}{\partial T}\right)_p = \frac{H_0 - H}{R}$

27. In streaming potential, the potential is developed due to :
- (A) Flow of liquid
 - (B) Applied potential
 - (C) Movement of solid particles
 - (D) None of these
28. Streaming potential is directly related to the zeta potential by the equation :
- (A) $S = \frac{\xi P D}{4\pi\eta K}$
 - (B) $S = \frac{\xi P}{4\pi\eta}$
 - (C) $S = \frac{4\pi\eta}{\xi P}$
 - (D) None of these
29. Which is correct for Gouy-Chapman model for electrical double layer :
- (A) Excess charge density on OHP, $Q_{OHP} = -Q_M$
 - (B) Excess charge density on OHP, $Q_{OHP} < Q_M$
 - (C) Excess charge density on OHP, $Q_{OHP} > Q_M$
 - (D) None of these
30. In which model of the electrical double layer, the potential falls very sharply along the straight line :
- (A) Stern Model
 - (B) Helmholtz-Perrin model
 - (C) Gouy-Chapman model
 - (D) All of the above

31. Activity of a substance in its standard state must be equal to :

- (A) 0
- (B) 2
- (C) 1
- (D) 1 · 2

32. Which of the following equation is used for determine zeta potential in the case of electro-osmosis ?

- (A) $\xi = \frac{4\pi\eta\mu_e}{D}$
- (B) $\xi = \frac{2DE}{QP}$
- (C) $\xi = \frac{\pi r^2 P}{2DE}$
- (D) None of these

33. The total differential capacity of an electrified interface is given by Helmholtz and Gouy capacities in series. This statements is related to :

- (A) Helmholtz-Perrin model
- (B) Gouy-Chapman model
- (C) Stern model
- (D) None of these

34. The Joule Thomson coefficient is :

(A) $\left(\frac{\partial T}{\partial P}\right)_H$

(B) $\left(\frac{\partial P}{\partial T}\right)_H$

(C) $\left(\frac{\partial H}{\partial P}\right)_T$

(D) $\left(\frac{\partial H}{\partial T}\right)_P$

35. The conductance of a strong electrolyte in aqueous solution increases to a certain limiting value with increase in potential gradient applied. This observation is known as :

(A) Debye-Huckel theory

(B) Debye-Falkenhagen effect

(C) Wien effect

(D) None of these

36. Which of the following is not Maxwell relation ?

(A) $\left(\frac{\partial T}{\partial V}\right)_S = \left(\frac{\partial P}{\partial S}\right)_V$

(B) $\left(\frac{\partial T}{\partial P}\right)_S = -\left(\frac{\partial S}{\partial T}\right)_P$

(C) $\left(\frac{\partial S}{\partial V}\right)_T = -\left(\frac{\partial P}{\partial T}\right)_V$

(D) All of above

37. The change of fugacity with pressure can be expressed by the equation :

(A) $\ln(f_1/f_2) = \frac{1}{RT} \int_{P_1}^{P_2} V dp$

(B) $\ln(f_2/f_1) = \frac{1}{RT} \int_{P_1}^{P_2} V dp$

(C) $\ln(f_2/f_1) = RT \int_{P_1}^{P_2} V dp$

(D) $\ln(f_1 f_2) = RT \int_{P_1}^{P_2} V dp$

38. Zeta potential developed at the surface of solid particle, in the phenomenon of electrophoresis, is expressed by the equation :

(A) $\xi = 4\pi\eta\mu_e D$

(B) $\xi = \frac{4\pi\eta\mu_e}{D}$

(C) $\xi = \frac{D}{4\pi\eta\mu_e}$

(D) None of these

39. The value of limiting current density is given by :

(A) $i_d = \frac{D_n F}{\delta} C^\circ$

(B) $i_d = \frac{\delta}{D_n F} C^\circ$

(C) $i_d = \frac{\delta}{D_n F}$

(D) None of above

40. The partial molar volume of component 2 in the mixture of 2 component system

is :

(A) $V_{2,m} = \left(\partial V / \partial n_2 \right)_{T,P,n_2}$

(B) $V_{2,m} = \left(\partial V / \partial n_1 \right)_{T,P,n_2}$

(C) $V_{2,m} = \left(\partial V / \partial n_1 \right)_{T,P,n_1}$

(D) $V_{2,m} = \left(\partial V / \partial n_2 \right)_{T,P,n_1}$

खण्ड-ब (बहुविकल्पीय)

Section-B (Objective)

CHE 507

M.Sc. IInd SEMESTER EXAMINATION, 2022

CHEMISTRY

(Analytical Chemistry)

Credit (4+0)

(CBCS Mode)

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Date (तिथि) : _____

5094

अनुक्रमांक (अंकों में) :

Roll No. (In Figures) :

अनुक्रमांक (शब्दों में) :

Roll No. (In Words) :

Time : 1½ Hrs.

समय : 1½ घण्टे

Max. Marks : 60

अधिकतम अंक : 60

नोट : पुस्तिका में 40 प्रश्न दिये गये हैं, सभी प्रश्न करने होंगे। प्रत्येक प्रश्न 1.5 अंक का होगा।

Important Instructions :

1. The candidate will write his/her Roll Number only at the places provided for, i.e. on the cover page and on the OMR answer sheet at the end and nowhere else.
2. Immediately on receipt of the question booklet, the candidate should check up the booklet and ensure that it contains all the pages and that no question is missing. If the candidate finds any discrepancy in the question booklet, he/she should report the invigilator within 10 minutes of the issue of this booklet and a fresh question booklet without any discrepancy be obtained.

महत्वपूर्ण निर्देश :

1. अभ्यर्थी अपने अनुक्रमांक केवल उन्हीं स्थानों पर लिखेंगे जो इसके लिए दिये गये हैं, अर्थात् प्रश्न पुस्तिका के मुख्य पृष्ठ तथा साथ दिये गये ओ०एम०आर० उत्तर पत्र पर, तथा अन्यत्र कहीं नहीं लिखेंगे।
2. प्रश्न पुस्तिका मिलते ही अभ्यर्थी को जाँच करके सुनिश्चित कर लेना चाहिए कि इस पुस्तिका में पूरे पृष्ठ हैं और कोई प्रश्न छूटा तो नहीं है। यदि कोई विसंगति है तो प्रश्न पुस्तिका मिलने के 10 मिनट के भीतर ही कक्ष परिप्रेक्षक को सूचित करना चाहिए और बिना त्रुटि की दूसरी प्रश्न पुस्तिका प्राप्त कर लेना चाहिए।

1. What is the principle of Nephelometry ?
 - (A) Light scattered
 - (B) Light transmitted
 - (C) Both (A) and (B)
 - (D) None of above
2. What is the principle of turbidimetry ?
 - (A) Light scattered
 - (B) Light transmitted
 - (C) Both (A) and (B)
 - (D) None of above
3. Which of the following is not a detector used in flame photometers ?
 - (A) Photonic cell
 - (B) Photovoltaic cell
 - (C) Photoemissive tube
 - (D) Chromatogram
4. In chromatography which of the following can be mobile phase be made of ?
 - (A) Solid or liquid
 - (B) Liquid or gas
 - (C) Gas only
 - (D) Liquid only
5. Which of the following is used as a carrier gas in gas chromatography ?
 - (A) Carbon dioxide
 - (B) Oxygen
 - (C) Helium
 - (D) Methane

6. In reverse phase chromatography, the stationary phase is made of :
- (A) Non polar
 - (B) Polar
 - (C) Both (A) and (B)
 - (D) None of above
7. Chromatography with solid stationary phase is called :
- (A) Circle chromatography
 - (B) Square chromatography
 - (C) Solid chromatography
 - (D) Adsorption chromatography
8. Which of these particles are highly penetrating ?
- (A) Alpha particles
 - (B) Beta particles
 - (C) Gamma particles
 - (D) X-ray
9. In the application of DTA and DSC which of the following parameters is measured for the glasses ?
- (A) Concentration of glass
 - (B) Solubility of the glass
 - (C) Cooling temperature
 - (D) Transition temperature
10. DTA can be used for which of the following process ?
- (A) Line position of the crystal
 - (B) Mechanical properties of the crystal
 - (C) Phase diagram
 - (D) Catalytic properties of enzymes

11. What is the temperature required for the decomposition of CaCO_3 in degree Celsius ?
- (A) 200
 - (B) 500
 - (C) 300
 - (D) 1200
12. Which of the following electrodes are often used as counter or auxiliary electrode in voltammetry ?
- (A) Calomel electrode
 - (B) Platinum eerier
 - (C) Carbon paste
 - (D) Mercury thin film
13. Which of the following is not used as electrode in voltammetry ?
- (A) Auxiliary electrode
 - (B) Reference electrode
 - (C) Working electrode
 - (D) Conducting electrode
14. In denial cell Zn/Zn SO_4 acts as :
- (A) Cathode
 - (B) Anode
 - (C) Both
 - (D) Reference electrode
15. The electrode potentials are calculated by :
- (A) Ilkovic equation
 - (B) Nernst equation
 - (C) Stokes equation
 - (D) Ohm's law

16. If the ion size is decreased in the solution :
- (A) Conductance decreases
 - (B) Conductance increases
 - (C) Both (A) and (B)
 - (D) None of the above
17. Which is not applicable for conductometry ?
- (A) Determination of water content
 - (B) Purity of water
 - (C) Ionic product of water
 - (D) Conductometric titrations
18. In the application of PTA and DSC which of the following parameter is measured for the glasses ?
- (A) Concentration of the glass
 - (B) Solubility of the glass
 - (C) Cooling temperature
 - (D) Transition temperature
19. Which of these is not an ion selective electrode ?
- (A) Thermistors
 - (B) Glass electrode
 - (C) Glass pH electrode
 - (D) Solid state electrode
20. Mode of operation in AFM :
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5

21. Laminar flow burner used in flame photometers is also known as _____.
 (A) Turbulent burner
 (B) Premix burner
 (C) Total consumption burner
 (D) Nozzle mix burner
22. In a flame emission photometry the measurement of _____ is used for quantitative analysis.
 (A) Intensity
 (B) Colour
 (C) Velocity
 (D) Frequency
23. In Ilkovic equation : $(id)_{max} = 706 n D^{\frac{1}{2}} m^{\frac{2}{3}} t^{\frac{1}{6}} C$. The product $m^{\frac{2}{3}} \cdot t^{\frac{1}{6}}$ is known as :
 (A) Half wave potential
 (B) Capillary constant
 (C) Ilkovic constant
 (D) None of the above
24. In the schematic DTA sequence having reversible and irreversible changes, starting with the hydrated materials which of the following step occur first on heating ?
 (A) Esterification
 (B) Hysteresis
 (C) Methylation
 (D) Carboxylation
25. In reversed phase HPLC there is a :
 (A) Polar solvent/non polar solvent
 (B) Polar solvent/non polar column
 (C) Non polar solvent/non polar column
 (D) None of the above

26. The diffusion current is measured in late life period of measuring drop in :
- (A) Pulsed polarography
 - (B) Differential pulsed polarography
 - (C) Tast polarography
 - (D) Voltammetry
27. DTA can be used for which of the following process ?
- (A) Line position of the crystals
 - (B) Mechanical properties of the crystals
 - (C) Phase diagrams
 - (D) Catalytic properties of enzyme
28. In thermo-gravimetric analysis the result obtained appears as a _____.
- (A) Continuous chart
 - (B) Continuous parabola
 - (C) Continuous circular position
 - (D) Discontinuous chart
29. Polarographic cells are not sensitive to which of the following gases ?
- (A) Carbon mono-oxide
 - (B) Carbon dioxide
 - (C) Nitrous oxide
 - (D) Oxygen
30. Which of the following methods is widely used method for trace gas analysis ?
- (A) Galvanic methods
 - (B) Conductometric method
 - (C) Polarographic cells
 - (D) Thermal conductivity method

31. Polarographic cells type of electrochemical method uses which of the following concept ?
- (A) Cyclic reaction
 - (B) Exothermic reaction
 - (C) Reversible reaction
 - (D) Redox- reaction
32. _____ is one in which the sensing element is a very thin hydrated glass membrane.
- (A) Solid state electrode
 - (B) Glass electrode
 - (C) Thermistor
 - (D) Glass pH electrode
33. Potentiometric bio sensor uses _____ in order to transduce the biological reaction into an electrical signal.
- (A) Clark oxygen electrode
 - (B) Ion selective electrode
 - (C) Thermistors
 - (D) Colorimetric test strip
34. In hydrogen electrode which material are used as coating of platinum foil ?
- (A) Pb
 - (B) Cu
 - (C) Platinum black
 - (D) Fe
35. Which device is used to convert physical or chemical energy to electrical energy?
- (A) Cell
 - (B) Galvanometer
 - (C) ECG
 - (D) None of these

36. Which $\cap$ part of the cell is responsible to between two solution that allows the movement of current in the form of ionic charge ?
- (A) Electrode
 - (B) Platinum wire
 - (C) Salt bridge
 - (D) None of the above
37. Which technique is used to measure emf. ?
- (A) Acid-base titration
 - (B) Mass spectroscopy
 - (C) TGC
 - (D) Potentiometry
38. Good conductors have many loosely bound :
- (A) Protons
 - (B) Atoms
 - (C) Molecules
 - (D) Electrons
39. The reciprocal of resistivity of a conductor is :
- (A) Potential
 - (B) Capacitance
 - (C) Conductivity
 - (D) None of these
40. Cell constant of an electrolyte cell is _____.
- (A) Length $\times$ area
 - (B) Length/area
 - (C) Area/length
 - (D) None of these
