Maximum Marks: 60
Total No. of Questions: 60
Total Duration: 80 Minutes
Maximum Time for Answering: 70 Minutes
Time: 02.30 pm to 03.50 pm

A3

Aakash
Medical | IIT-JEE | Foundations

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Answers & Solutions
for
Karnataka Common Entrance Test-2025 (CHEMISTRY)

Time : 80 Minutes   M.M. : 60

Dos:

1   This question booklet is issued to you by the room invigilator after 02.30 pm.

2   Check whether the CET Number has been entered and shaded in the respective circles on the OMR answer sheet.

3   The version code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.

4   The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.

5   Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DONTs:

1) **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED / MUTILATED / SPOILED.**

2) The **3rd Bell rings at 02.40 pm, till then.**

   i.   Do not remove the seal present on the right-hand side of this question booklet.

   ii. Do not look inside this question booklet or start answering on the OMR. answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1   In case of usage of signs and symbols in the questions, the regular textbook connotation should be considered unless stated otherwise.

2   This question booklet contains 60 questions, and each question will have one statement and four different options / responses & out of which you have to choose one correct answer.

3   After the **3d Bell rings at 02.40 pm,** remove the paper seal of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.

4   Completely **darken / shade** the relevant circle with a **blue or black ink ballpoint pen against the question number on the OMR answer sheet.**

5   Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.

6   Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.

7   **Last Bell will ring at 03.50 pm**, stop writing on the OMR answer sheet,

8   Hand over the OMR answer sheet to the room invigilator as it is.

9   After separating the top sheet (Office copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you.

   NOTE: In case of any discrepancy between English and Kannada Versions, the English version will be taken as final.

1. For a given half-cell, $Al^{3+} + 3e^- \rightarrow Al$ on increasing the concentration of aluminum ion, the electrode potential will

(1) No change

(2) First increase then decrease

(3) Increase

(4) Decrease

Key: Answer (3)

Sol: $Al^{3+} + 3e^- \rightarrow Al$

$$E_{cell} = E^o_{cell} - \frac{0.059}{n}\log\frac{I}{\left[Al^{3+}\right]}$$

$\left[Al^{3+}\right] \uparrow$, $E_{cell} \uparrow$

2. Match the following and select the correct option for the quantity of electricity, in $Cmol^{-1}$, required to deposit various metals at cathode.

	List –I		List-II
(a)	Ag^+	i.	386000 C mol^{-1}
(b)	Mg^{2+}	ii.	289500 C mol^{-1}
(c)	Al^{3+}	iii.	96500 C mol^{-1}
(d)	Ti^{4+}	iv.	193000 C mol^{-1}

(1) a-iii, b-iv, c-ii, d-I

(2) a-iv, b-iii, c-I, d-ii

(3) a-i, b-ii, c-iii, d-iv

(4) a-ii, b-i, c-iv, d-iii

Key: Answer (1)

Sol:
(a) $Ag^+ + e^- \rightarrow Ag, 1 \times 96500\,Cmol^{-1}$

(b) $Mg^{2+} + 2e^- \rightarrow Mg, 2 \times 96500\,Cmol^{-1}$

(c) $Al^{3+} + 3e^- \rightarrow Al, 3 \times 96500\,Cmol^{-1}$

(d) $Ti^{4+} + 4e^- \rightarrow Ti, 4 \times 96500\,Cmol^{-1}$

3. Catalysts are used to increase the rate of a chemical reaction. Because it

(1) Decreases the activation energy of the reaction

(2) Brings about improper orientation of reactant molecules

(3) Increases the potential energy barrier

(4) Increases the activation energy of the reaction

Key: Answer (1)

Sol: In presence of catalyst reaction proceeds through lower activation energy path

4. Half–life of a first order reaction is 20 seconds and initial concentration of reactant is 0.2M. The concentration of reactant left after 80 seconds is
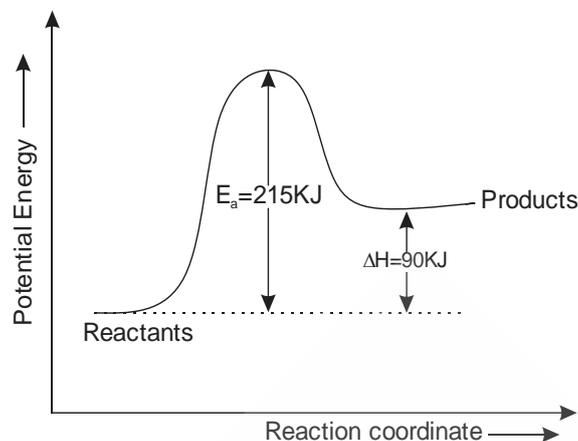
(1) 0.05 M   (2) 0.0125 M

(3) 0.2 M   (4) 0.1 M

Key: Answer (2)

Sol: $t_{1/2} = 20\,sec$, total time = 80 sec

$$0.2M \xrightarrow{20s} 0.1\,M \xrightarrow{20s} 0.05M \xrightarrow{20s} 0.025M \xrightarrow{20s} 0.0125M$$

5. In the given graph. E_a for the reverse reaction will be

(1) 215 KJ   (2) 90 KJ

(3) 305 KJ   (4) 125 KJ

Key: Answer (4)

Sol: $E_{rev} = E_a - \Delta H = 215 - 90 = 125KJ$

6. For the reaction $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$ initial concentration of N_2O_5 is 2.0 $molL^{-1}$ and after 300 min, it is reduced to 1.4 mol L^{-1}. The rate of production of NO_2 (in mol L^{-1} min^{-1}) is

(1) 4×10^{-4} (2) 2.5×10^{-3}

(3) 4×10^{-3} (4) 2.5×10^{-4}

Key: Answer (3)

Sol:
$$-\frac{1}{2}\frac{d}{dt}[N_2O_5] = +\frac{1}{4}\frac{d}{dt}[NO_2]$$

$$\frac{d}{dt}[NO_2] = 2 \times \left[-\frac{d}{dt}[N_2O_5]\right] = 2 \times (2 - 1.4)$$

$$= 1.2\,molL^{-1} \text{ in 300 min}$$

$$= \frac{1.2}{300}\,molL^{-1}min^{-1}$$

$$= 4 \times 10^{-3}\,molL^{-1}min^{-1}$$

7. Which of the following methods of expressing concentration are unitless?

    (1) Molality and Mole fraction

    (2) Mass percent (W/W) and Molality

    (3) Molality and Molarity

    (4) Mole fraction and Mass percent (W/W)

Key: Answer (4)

Sol: Mole fraction is ratio between moles & mass fraction is ratio between mass so both are unitless

8. Select the INCORRECT statement/s from the following:

    (a) 22 books have infinite significant figures.

    (b) In the answer of calculation 2.5×1.25 has four significant figures.

    (c) Zero's preceding to first non-zero digit are significant.

    (d) In the answer of calculation $12.11 + 18.0 + 1.012$ has three significant figures

    (1) (b) and (c) only   (2) (b) and (d) only

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

Key: Answer (1)

Sol: 2.5 has two significant figures

    1.25 has three significant figures

    In multiplication/division, the result should have the least number of significant figures.

    These are called leading zeros and are not significant

    Example: 0.0034 has only two significant figures (The zeros are just placeholders)

9. Given below are the atomic masses of the elements.

Element:	Li	Na	Cl	K	Ca	Br	Sr	I	Ba
Atomic Mass $\left(g \, mol^{-1}\right)$:	7	23	35.5	39	40	80	88	127	137

    Which of the following doesn't form triad?

    (1) Cl, Br, I   (2) Cl, K, Ca

    (3) Li, Na, K   (4) Ba, Sr, Ca

Key: Answer (2)

Sol: Atomic mass of 'K' is not equal in the average of atomic masses of "Cl & Ca"

10. The change in hybridisation (if any) of the 'Al' atom in the following reaction is $AlCl_3 + Cl^- \rightarrow AlCl_4^-$

(1) sp^2 to sp^3

(2) sp^3 to sp^3d

(3) sp^3 to sp^2

(4) No change in the hybridisation state

Key: Answer (1)

Sol: Hybridisation of Al in $AlCl_3$ in sp^2 and in $AlCl_4^-$ hybridisation of Al is sp^3

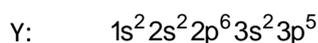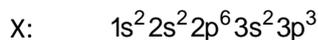11. Match List-I with List-II and select the correct option:

List-I (molecule/ion)		List-II (Bond order)	
(a)	NO	i.	1.5
(b)	CO	ii.	2.0
(c)	O_2^-	iii.	2.5
(d)	O_2	iv.	3.0

(1) a-i, b-iv, c-iii, d-ii

(2) a-ii, b-iii, c-iv, d-i

(3) a-iv, b-iii, c-ii, d-i

(4) a-iii, b-iv, c-I, d-ii

Key: Answer (4)

Sol : Bond order = $\frac{1}{2}$ [Bonding electrons – Anti-bonding electrons]

12. The electronic configuration of X and Y are given below :

X: $1s^2 2s^2 2p^6 3s^2 3p^3$

Y: $1s^2 2s^2 2p^6 3s^2 3p^5$

Which of the following is the correct molecular formula and type of bond formed between X and Y?

(1) X_2Y_3 , coordinate bond

(2) XY_3 , covalent bond

(3) X_2Y , covalent bond

(4) X_3Y , ionic bond

Key: Answer (2)

Sol: Valency of X is 3

Valency of Y is 1

$\therefore$ Formula is XY_3

And nature of bond is covalent

13. Match List-I with List-II

List-I (Type of redox reactions)		List-II (Examples)	
(a)	Combination reaction	(i)	$Cl_{2(g)} + 2Br_{(aq)}^- \rightarrow 2Cl_{(aq)}^- + Br_{2(l)}$
(b)	Decomposition reaction	(ii)	$2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$
(c)	Displacement reaction	(iii)	$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + 2H_2O_{(l)}$
(d)	Disproportionation reaction	(iv)	$2H_2O_{(l)} \xrightarrow{\Delta} 2H_{2(g)} + O_{2(g)}$

Choose the correct answer from the options given below.

(1) a–ii, b–i, c–iv, d–iii

(2) a–iii, b–iv, c–i, d–ii

(3) a–iii, b–ii, c–i, d–iv

(4) a–iv, b–iii, c-i, d-ii

Key: Answer (2)

Sol : $2H_2O_{(l)} \xrightarrow{\Delta} 2H_{2(g)} + O_{2(g)}$ is a decomposition reaction

14. In the following pairs, the one in which both transition metal ions are colourless is

   (1) V^{2+}, Ti^{3+}

   (2) Zn^{2+}, Mn^{2+}

   (3) Ti^{4+}, Cu^{2+}

   (4) Sc^{3+}, Zn^{2+}

Key: Answer (4)

Sol: Due to lack of unpaired electrons in d – orbital

15. In the reaction between hydrogen sulphide and acidified permanganate solution,

   (1) H_2S is oxidised to SO_2, MnO_4^- is reduced to MnO_2

   (2) H_2S is reduced to SO_2, MnO_4^- is oxidised to Mn^{2+}

   (3) H_2S is oxidised to S, MnO_4^- is reduced to Mn^{2+}

   (4) H_2S is reduced to S, MnO_4^- is oxidised to Mn^{2+}

Key: Answer (3)

Sol: $2KMnO_4 + 3H_2SO_4 + 5H_2S \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5S$

16. A member of the Lanthanoid series which is well known to exhibit +4 oxidation state is

   (1) Europium

   (2) Erbium

   (3) Cerium

   (4) Samarium

Key: Answer (3)

Sol: Cerium can show +3 and +4 oxidation states.

   Europium and Samarium can show +2 and +3 oxidation states

17. In which of the following pairs, both the elements do not have $(n-1)d^{10}ns^2$ configuration?

   (1) Zn, Cd

   (2) Cd, Hg

   (3) Ag, Cu

   (4) Cu, Zn

Key: Answer (3)

Sol: $Ag - [Kr]5s^1 4d^{10}$

   $Cu - [Ar]4s^1 3d^{10}$

18. A ligand which has two different donor atoms and either of the two ligates with the central metal atom/ion in the complex is called _____

   (1) Unidentate ligand

   (2) Polydentate ligand

   (3) Ambidentate ligand

   (4) Chelate ligand

Key: Answer (3)

Sol: Ambidentate ligands contain two donor atom and either of them can donate to central atom

   Example CN^-, SCN^-, NO_2^-

19. Which of the following statements are true about $[NiCl_4]^{2-}$?

   (a) The complex has tetrahedral geometry

   (b) Co-ordination number of Ni is 2 and oxidation state is +4

   (c) The complex is sp^3 hybridised

   (d) It is a high spin complex

   (e) The complex is paramagnetic

   (1) a, b, d and e   (2) b, c, d and e

   (3) a, b, c and d   (4) a, c, d and e

Key: Answer (4) **[Bonus]**

Sol: This question has same option number mentioned for two option

$[NiCl_4]^{2-} - sp^3$ hybridization

   - Tetrahedral geometry
   - Coordination no of Ni is 4 and oxidation states is +2
   - High spin complex, no pairing happens, Cl^- is weak field ligand
   - Paramagnetic with 2 unpaired electron in 3d orbital of Ni

20. Which of the formula and its name combination is incorrect?

   (1) $[CoCl_2(en)_2]Cl$, Dichloridobis (ethane – 1,2 – diamine) cobalt (III) chloride

   (2) $[Co(NH_3)_5(CO_3)]Cl$, Pentaamine carbonylcobalt (III) chloride

   (3) $[Pt(NH_3)_2Cl(NO_2)]$ Diamine chloridonitrito – N – platinum (II)

   (4) $K_3[Cr(C_2O_4)_3]$, Potassium trioxalatochromate (III)

Key: Answer (2,3)

Sol: Complex $-[Co(NH_3)_5(CO_3)]Cl$

Correct IUPAC Name – Pentaamminecarbonatocobalt (III) Chloride

IUPAC Name of NH_3 is ammine. So, both option (2) and (3) are incorrect.

21. In the complex ion $[Fe(C_2O_4)_3]^{3-}$, the Co-ordination number of Fe is

   (1) 5   (2) 6   (3) 3   (4) 4

Key: Answer (2)

Sol: $C_2O_4^{2-}$ is bidentate ligand

22. Match List-I with List-II for the following reaction pattern

$$Glucose \xrightarrow{\text{Reagent}} Product \longrightarrow Structural\ prediction$$

	List-I (Reagents)		List-II (Structural prediction)
(a)	Acetic anhydride	(i)	Glucose has an aldehyde group
(b)	Bromine water	(ii)	Glucose has a straight chain of six carbon atoms
(c)	Hydroiodic acid	(iii)	Glucose has five hydroxyl groups
(d)	Hydrogen cyanide	(iv)	Glucose has a carbonyl group

Choose the correct answer from the options given below.

(1) $a - iii, b - i, c - ii, d - iv$

(2) $a - i, b - ii, c - iii, d - iv$

(3) $a - iii, b - ii, c - i, d - iv$

(4) $a - iv, b - iii, c - ii, d - i$

Key: Answer (1)

Sol: Acetic anhydride reacts with – OH group and help in identifying no of hydroxyl groups

Bromine water is mild oxidizing agent, which can oxidize aldehyde to acids of carbohydrates

Hydroiodic acid (HI) in presence of Red P can reduce – OH and – CHO of glucose and convert it to straight chain of six carbon atoms

23. The correct sequence of α-amino acid, hormone, vitamin, carbohydrates respectively is

(1) Glutamine, Insulin, Aspartic acid, Fructose

(2) Arginine, Testosterone, Glutamic acid, Maltose

(3) Aspatic acid, Insulin, Ascorbic acid, rhamnose

(4) Thiamine, Thyroxine, Vitamin A, Glucose

Key: Answer (3)

Sol: Aspartic acid – α–amino acid

Insulin – Harmone

Ascorbic acid – Vitamin C

Rhamnose – deoxy sugar

24. Which examples of carbohydrates exhibit α - link (α -glycosidic link) in their structure?

(1) Amylose and Amylopectin

(2) Cellulose and Glycogen

(3) Glucose and Fructose

(4) Maltose and Lactose

Key: Answer (1)

Sol: Amylose and amylopectin are polymers of α – glucose present in starch

Cellulose is polymer of β–glucose

Glycogen is polymer of α – glucose

Maltose is disaccharide of α – glucose

Lactose is disaccharide of galactose and glucose with β–glycosidic linkage.

25. In the titration of potassium permanganate $(KMnO_4)$ against Ferrous ammonium sulphate (FAS) solution, dilute sulphuric acid but not nitric acid is used to maintain acidic medium, because

    (1) Nitric acid doesn't act as an indicator

    (2) Nitric acid itself is an oxidising agent

    (3) Nitric acid is a weak acid than sulphuric acid

    (4) It is difficult to identify the end point

Key: Answer (2)

Sol: Nitric acid is an oxidizing agent

26. The group reagent $NH_4Cl(s)$ and aqueous NH_3 will precipitate which of the following ion?

    (1) Al^{3+} (2) Ba^{2+} (3) Ca^{2+} (4) NH_4^+

Key: Answer (1)

Sol: $NH_4Cl + NH_3$ or NH_4OH is group III reagent. It will precipitate Al^{3+}, Fe^{3+} and Cr^{3+} ions as hydroxides.

27. In the preparation of sodium fusion extract, the purpose of fusing organic compound with a piece of sodium metal is to

    (1) Convert the elements of the compound from covalent form to ionic form

    (2) Convert the elements of the compound from ionic form to covalent form

    (3) Decrease the melting point of the compound

    (4) Convert the organic compound into vapour state

Key: Answer (1)

Sol: In sodium fusion extract element of organic compound will get converted to ionic form

    Example: $Na(s) + C_2H_5Cl \xrightarrow{\text{fuse}} NaCl$

                      Covalent   Ionic
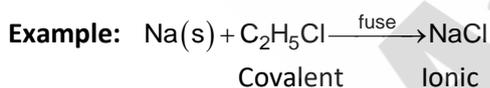
28. The sodium fusion extract is boiled with concentrated nitric acid while test for halogens. By doing so, it

    (1) increases the solubility of AgCl

    (2) increases the concentration of NO_3^- ion

    (3) decomposes Na_2S and NaCN, if formed

    (4) helps in precipitation of AgCl

Key: Answer (3)

Sol: HNO_3 decomposes Na_2S and NaCN to SO_2 and NO_2 respectively and prevents the interference of these ions while testing for halides

29. Which of the following is not an aromatic compound?

(1)
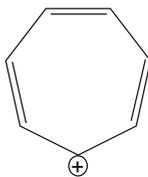
(2)
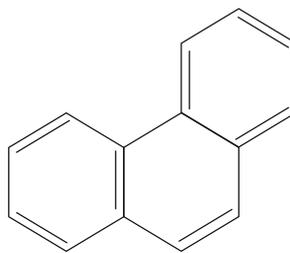
(3)
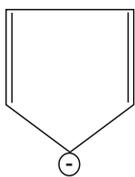
(4)
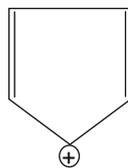
Key: Answer (4)

Sol:
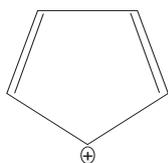
is anti – aromatic compounds

30. The IUPAC name of the given compound is
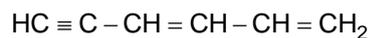
$$HC \equiv C - CH = CH - CH = CH_2$$

(1) Hexa-5-yn-1, 3-diene

(2) Hexa-1, 3-dien-5-yne

(3) Hexa-3, 5-dien-1-yne

(4) Hexa-1-yn-3, 5-diene

Key: Answer (2)

Sol: $HC \equiv C - CH = CH - CH = CH_2$

Hexa – 1,3 – dien – 5 – yne

31. Among the following, identify the compound that is not an isomer of hexane

(1) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$

(2)
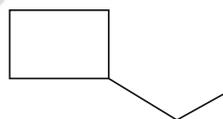
(3) $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{CH} - CH_2 - CH_2 - CH_3$

(4) $CH_3 - CH_2 - \overset{}{\underset{\underset{\displaystyle CH_3}{|}}{CH}} - CH_2 - CH_3$

Key: Answer (2)

Sol: Hexane has $DU = 0$

Compound mentioned in option (2) has $DU = 1$ so it can't be isomer

32. The organic compound

 can be classified as _____
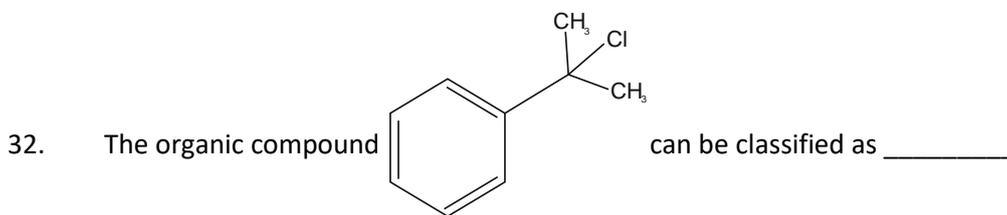
    (1) Benzyl halide   (2) Aryl halide   (3) Alkyl halide   (4) Allylic halide

Key: Answer (1)

Sol: Based on theory

33. Chlorobenzene reacts with bromine gas in the presence of Anhyd $AlBr_3$ to yield

    p-Bromochlorobenzene. This reaction is classified as _____
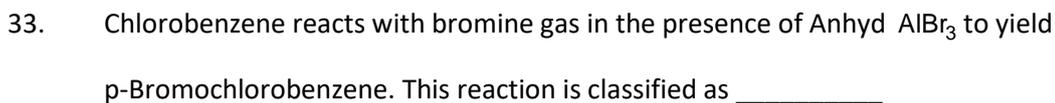
    (1) Nucleophilic substitution reaction

    (2) Electrophilic substitution reaction

    (3) Addition reaction

    (4) Elimination reaction

Key: Answer (2)

Sol: Based on theory
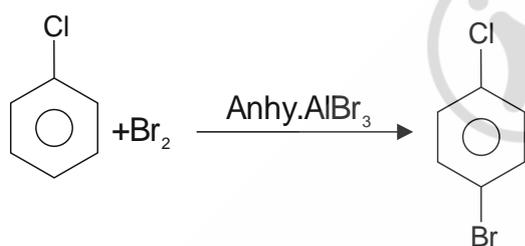
    This is electrophilic substitution reaction

34. The organometallic compound $(CH_3)_3 CMgBr$ on reaction with D_2O produces_____

    (1) $(CD_3)_3 CD$ (2) $(CD_3)_3 COD$

    (3) $(CH_3)_3 CD$ (4) $(CH_3)_3 COD$

Key: Answer (3)
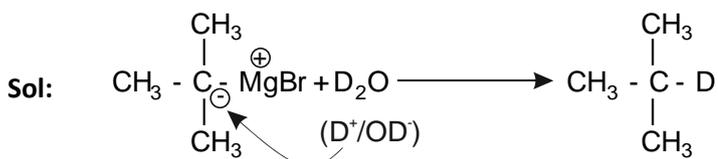
Sol:

35.   The major product formed when 1-Bromo-3-Chlorocyclobutane reacts with metallic sodium in dry ether is

(1)

(2)

(3)

Br

(4)

Cl

Key: Answer (2)

Sol:
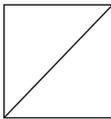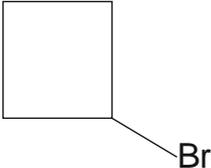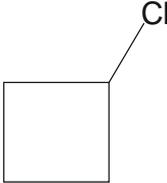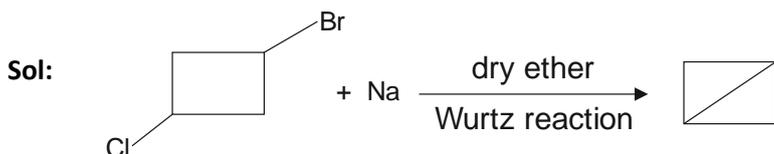
36.   Ethyl alcohol is heated with concentrated sulphuric acid at 413 K. The major product formed is

(1) $CH_3 - O - C_3H_7$

(2) $CH_2 = CH_2$

(3) $CH_3COOC_2H_5$

(4) $C_2H_5 - O - C_2H_5$

Key: Answer (4)

Sol: $2CH_3 - CH_2 - OH + Conc.H_2SO_4 \xrightarrow{413K} C_2H_5 - O - C_2H_5$

37.   Phenol can be distinguished from propanol by using the reagent

(1)   Iron metal

(2)   Iodine in alcohol

(3)   Sodium metal

(4)   Bromine water

Key: Answer (4)

Sol: Propanol $(CH_3 - CH_2 - CH_2 - OH)$ does not react with bromine water

38.   Match the following with their pKa values

	Acid		pKa
(I)	Phenol	(a)	16
(II)	p-Nitrophenol	(b)	0.78
(III)	Ethyl alcohol	(c)	10
(IV)	Picric acid	(d)	7.1

(1)   I – a, II – d, III – c, IV – b

(2)   I – a, II – b, III – c, IV – d

(3)   I – b, II – a, III – d, IV – c

(4)   I – c, II – d, III – a, IV – b
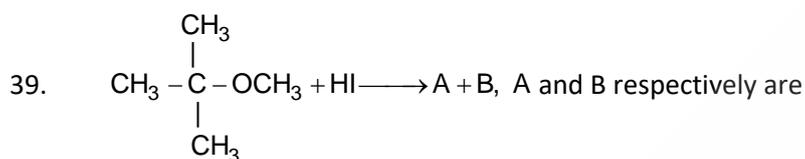
Key: Answer (4)

Sol:
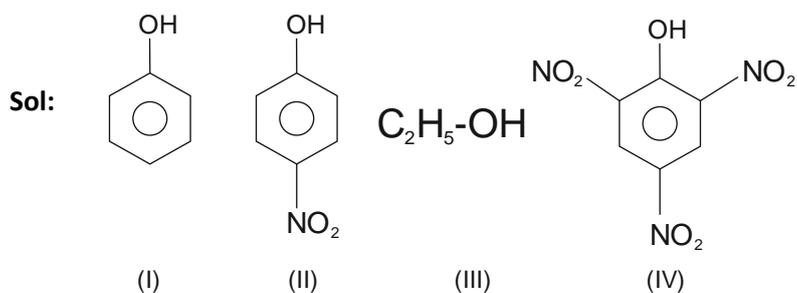
(I)   (II)   (III)   (IV)

[Acidic strength α EWG]

Acidic strength order $\Rightarrow (IV) > (II) > (I) > (III)$

pKa order $\Rightarrow (III) > (I) > (II) > (IV)$
$\quad\quad\quad\quad\quad$ 16 $\quad$ 10 $\quad$ 7.1 $\quad$ 0.78
$\quad\quad\quad\quad\quad$ (a) $\quad$ (c) $\quad$ (d) $\quad$ (b)

39.
$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OCH_3 + HI \longrightarrow A + B, \text{ A and B respectively are}$$

(1) $A = CH_3OH, B = CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - I$

(2) $A = CH_3 - I, B = CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - I$

(3) $A = CH_3OH, B = CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH$

(4) $A = CH_3 - I, B = CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH$

Key: Answer (1)

Sol:
$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - O - CH_3 + HI \longrightarrow CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - I + CH_3OH$$
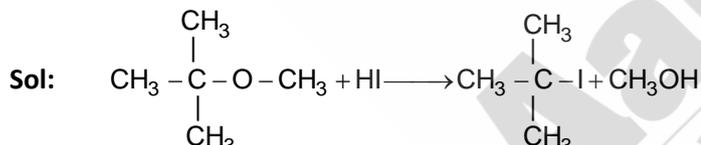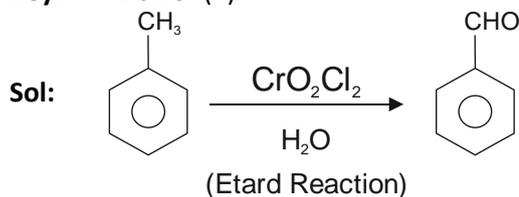
40. Oxidation of Toluene with chromyl chloride followed by hydrolysis gives Benzaldehyde. This reaction is known as _____

(1) Kolbe reaction

(2) Stephen reaction

(3) Cannizzaro reaction

(4) Etard reaction

Key: Answer (4)

Sol:

(Etard Reaction)

41. **Statement-I:** Reduction of ester by DIBAL-H followed by hydrolysis gives aldehyde

    Statement-II: Oxidation of benzyl alcohol with aqueous $KMnO_4$ leads to the formation of Benzaldehyde.

    Among the above statements, identify the correct statement.

    (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 II are true

    (4) Both statements-I and II are false

Key: Answer (1)

Sol: Statement – I is true but statement –II is false

42. Arrange the following compounds in their decreasing order of reactivity towards Nucleophilic addition reaction.

    CH_3COCH_3, $CH_3COC_2H_5$, CH_3CHO

    (1) $CH_3COCH_3 > CH_3CHO > CH_3COC_2H_5$

    (2) $CH_3COC_2H_5 > CH_3COCH_3 > CH_3CHO$

    (3) $CH_3CHO > CH_3COC_2H_5 > CH_3COCH_3$

    (4) $CH_3CHO > CH_3CO\ CH_3 > CH_3\ CO\ C_2H_5$

Key: Answer (4)

Sol:
$$\left[\text{Rate of nucleophilic addition reaction} \propto \frac{1}{\text{steric hindrence}} \right]$$

$$\underset{O}{CH_3-\overset{\|}{C}-C_2H_5} < \underset{O}{CH_3-\overset{\|}{C}-CH_3} < \underset{O}{CH_3-\overset{\|}{C}-H}$$
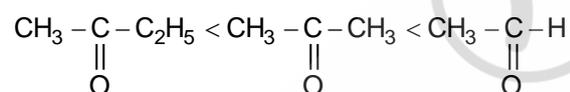
43. Which of the following has most acidic Hydrogen?

    (1) Dichloroacetic acid

    (2) Trichloroacetic acid

    (3) Chloroacetic acid

    (4) Propanoic acid

Key: Answer (2)

Sol: Based on theory

44. Which of the following reagents are suitable to differentiate Aniline and N-methylaniline chemically?

    (1) Br_2 water

    (2) Conc. Hydrochloric acid and anhydrous zinc chloride

    (3) Chloroform and Alcoholic potassium hydroxide

    (4) Acetic anhydride

Key: Answer (3)

Sol: 1° & 2° amines can be differentiated by carbylamine test

45. Which of the following reaction/s does not yield an amine?

I. $R-X+NH_3 \xrightarrow[(alc)]{\Delta}$

II. $R-C \equiv N \xrightarrow[Na(Hg)/C_2H_5OH]{H_2/Ni}$

III. $R-C \equiv N + H_2O \xrightarrow{H^+}$

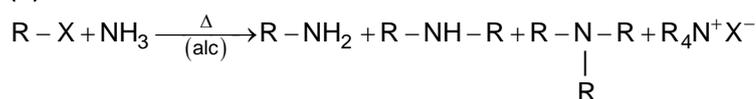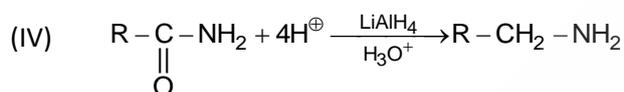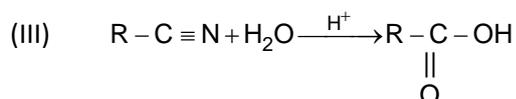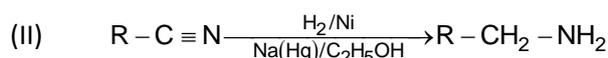IV. $R-\overset{\overset{O}{\|}}{C}-NH_2 + 4[H] \xrightarrow[ii)H_3O^+]{i)LiAlH_4}$

(1) Only II

(2) Only III

(3) Both II and IV

(4) Both I and III

Key: Answer (2)

Sol: (I) $R-X+NH_3 \xrightarrow[(alc)]{\Delta} R-NH_2 + R-NH-R + R-\underset{\underset{R}{|}}{N}-R + R_4N^+X^-$

(II) $R-C \equiv N \xrightarrow[Na(Hg)/C_2H_5OH]{H_2/Ni} R-CH_2-NH_2$

(III) $R-C \equiv N + H_2O \xrightarrow{H^+} R-\underset{\underset{O}{\|}}{C}-OH$

(IV) $R-\underset{\underset{O}{\|}}{C}-NH_2 + 4H^\oplus \xrightarrow[H_3O^+]{LiAlH_4} R-CH_2-NH_2$

46. Match the compounds given in List-I with the items given in List-II

	List-I		List-II
(I)	Benzenesulphonyl Chloride	(a)	Zwitterion
(II)	Sulphanilic acid	(b)	Hinsberg reagent
(III)	Alkyl Diazonium salts	(c)	Dyes
(IV)	Aryl Diazonium salts	(d)	Conversion to alcohols

(1) I -a, II-c, III-b, IV-d

(2) I -c, II-a, III-d, IV-b

(3) I -b, II-a, III-d, IV-c

(4) I -c, II-b, III-a, IV-d

Key: Answer (3)

Sol: $I-b, II-a, III-d, IV-c$

47. The number of orbitals associated with 'N' shell of an atom is

(1) 32 (2) 3 (3) 4 (4) 16

Key: Answer (4) **[Bonus]**

Sol:

K	L	M	N
1	2	3	4

No of orbitals $\alpha \, n^2$

$$\alpha \ 4^2 = 16$$

This question has same option number mentioned for two options

48. According to the Heisenberg's Uncertainty principle, the value of $\Delta v.\Delta x$ for an object whose mass is 10^{-6}kg is (h = 6.626×10^{-34} Js)

(1) 4.0×10^{-26} m^{-2}s^{-1} (2) 3.5×10^{-25}m^{-2}s^{-1}

(3) 5.2×10^{-29}m^{-2}s^{-1} (4) 3.0×10^{-24}m^{-2}s^{-1}

Key: Answer (3)

Sol: $\Delta x.\Delta p \geq \dfrac{h}{4\pi}$

$\Delta x.\Delta v \geq \dfrac{h}{4\pi m} \qquad \left(\dfrac{h}{4\pi} = 5.27 \times 10^{-35} \right)$

$\Delta x.\Delta v \geq \dfrac{5.2 \times 10^{-35}}{10^{-6}} \Rightarrow \Delta x.\Delta v = 5.2 \times 10^{-2} \ \text{sec}^{-1}$

49. Given below are two statements.

Statement-I: Adiabatic work done is positive when work is done on the system and internal energy of the system increases

Statement -II: No work is done during free expansion of an ideal gas.

In the light of the above statements, choose the correct answer from the options 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

Key: Answer (3)

Sol: (i) $\Delta E = Q + w$ (Adiabatic process Q = 0)

$\boxed{\Delta E = +w}$

(ii) Work done zero in free expansion

50. Which one of the following reactions has $\Delta H = \Delta U$?

(1) $C_6H_6(l) + \dfrac{15}{2}O_2(g) \longrightarrow 6CO_2(g) + 3H_2O(l)$

(2) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

(3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(4) $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

Key: Answer (2)

Sol: $\Delta H = \Delta E + \Delta nRT$

When $\Delta n = 0, \Delta H = \Delta E$

$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ $\qquad (\Delta n = 0)$
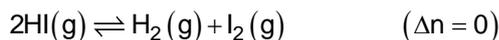
51. Identify the incorrect statements among the following:

    (a) All enthalpies of fusion are positive.

    (b) The magnitude of enthalpy change does not depend on the strength of the intermolecular interactions in the substance undergoing phase transformations.

    (c) When a chemical reaction is reversed, the value of $\Delta rH°$ is reversed in sign.

    (d) The change in enthalpy is dependent of path between initial state (reactants) and final state (products)

    (e) For most of the ionic compounds, $\Delta_{sol}H°$ is negative.

    (1) b, d and e   (2) a, d and e

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

Key: Answer (1)

Sol: Magnitude of enthalpy change depends on intermolecular force

ΔH is state function

Most of the compounds have $\Delta H(sol) = +ve(endothermic)$

52. Which of the following statements is/are true about equilibrium?

    (a) Equilibrium is possible only in a closed system at a given temperature

    (b) All the measurable properties of the system remain constant at equilibrium.

    (c) Equilibrium constant for the reverse reaction is the inverse of the equilibrium constant for the reaction in the forward direction.

    (1) Only c   (2) a, b and c   (3) Only a   (4) Only b

Key: Answer (2)

53. According to Le Chatelier's principle, in the reaction CO(g) + 3H$_2$(g) $\rightleftharpoons$ CH$_4$(g) + H$_2$O(g), the formation of methane is favoured by

    (A) increasing the concentration of CO   (B) increasing the concentration of H$_2$O

    (C) decreasing the concentration of CH$_4$ (D) decreasing the concentration of H$_2$

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

Key: Answer (4)

Sol: $CO + 3H_2 \rightleftharpoons CH_4 + H_2O$

$[R]\uparrow$, equilibrium shift forward

$[R]\downarrow$, equilibrium shift backward

$[P] \uparrow$, equilibrium shift backward

$[P] \downarrow$, equilibrium shift forward

54. The equilibrium constant at 298 K for the reaction $A + B \rightleftharpoons C + D$ is 100. If the initial concentrations of all the four species were 1M each, then equilibrium concentration of D (in mol L^{-1}) will be

(1) 1.818

(2) 1.182

(3) 0.818

(4) 0.182

Key: Answer (1)

Sol:

$$A + B \rightarrow C + D$$

$t = 0 \quad 1 \quad 1 \quad 1 \quad 1$

$t = eq \quad 1-\alpha \quad 1-\alpha \quad 1+\alpha \quad 1+\alpha$

$$K_{eq} = \frac{[C][D]}{[A][B]} = \frac{(1+\alpha)(1+\alpha)}{(1-\alpha)(1-\alpha)} = 100 = 10^2$$

$$= \left[\frac{(1+\alpha)}{(1-\alpha)}\right]^2 = 10^2$$

$$= 1+\alpha = (1-\alpha) \times 10$$

$$\Rightarrow 1+\alpha = 10 - 10\alpha$$

$$11\alpha = 9$$

$$\alpha = \frac{9}{11} = 0.8181$$

$\therefore$ at equilibrium conc. of 'D' is $= 1 + 0.8181 = 1.8181\,M$

55. Among the following 0.1m aqueous solutions, which one will exhibit the lowest boiling point elevation, assuming complete ionization of the compounds in solution?

(1) Aluminum sulphate

(2) Potassium sulphate

(3) Sodium chloride

(4) Aluminum chloride

Key: Answer (3)

Sol: $\Delta T_b = iK_b m \qquad (m = constant, K_b = constant, i = variable)$

$\therefore \boxed{\Delta T_b \; \alpha \; i}$

$T_b \, \alpha \, i$

$$Al_2(SO_4)_3, K_2SO_4, NaCl, AlCl_3$$

$i = \qquad 5 \qquad 3 \qquad 2 \quad 4$

56. Variation of solubility with temperature T for a gas in liquid is shown by the following graphs. The correct representation is

(1)

(2)

(3)

(4)
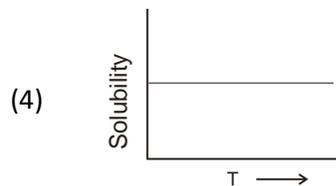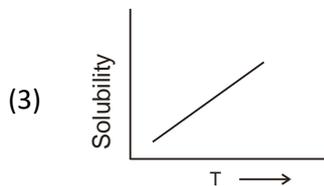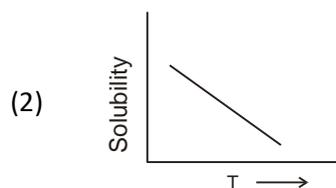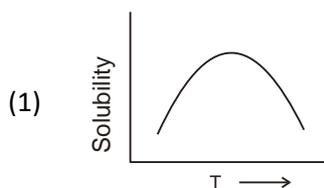
Key: Answer (2)

Sol: Temperature increases solubility of gas in liquid decreases

57. 180g of glucose, $C_6H_{12}O_6$, is dissolved in 1 kg of water in a vessel. The temperature at which water boils at 1.013 bar is _____ (given, K_b for water is 0.52 K kg mol^{-1}. Boiling point for pure water is 373.15 K)

(1) 373.15 K   (2) 373.0 K   (3) 373.202 K   (4) 373.67 K

Key: Answer (4)

Sol: $\Delta T_b = iK_b$ molarity

$\Rightarrow T_b(\text{solution}) - T_b(\text{solvent}) = 1 \times 0.52 \times \dfrac{180}{180} \times \dfrac{1}{1}$

$\Rightarrow T_b(\text{solution}) - T_b(\text{solvent}) = 0.52$

$T_b(\text{solution}) = 0.52 + 373.15 = 373.67K$

58. If N_2 gas is bubbled through water at 293 K, how many moles of N_2 gas would dissolve in 1 litre of water? Assume that N_2 exerts a partial pressure of 0.987 bar.

[Given K_H for N_2 at 293 K is 76.48 K bar]

(1) 7.16×10^{-5} (2) 7.16×10^{-4} (3) 7.16×10^{-3} (4) 0.716×10^{-3}

Key: Answer (2, 4)

Sol: Henry's law $P(g) = K_H X(g)$

$\Rightarrow 0.987 \text{ bar} = 76.48 \text{ K bar } X(g)$

$\Rightarrow X(g) = \dfrac{nB}{nA + nB} = \dfrac{0.987}{76.48 \times 10^3}$

$\Rightarrow nB = \dfrac{0.987}{76.48 \times 10^3} \times 55.5 \Rightarrow 7.16 \times 10^{-4}$ moles

Both options-2 & 4 are correct

59. The correct statement/s about Galvanic cell is/are

   (A) Current flows from cathode to anode
   (B) Anode is positive terminal
   (C) If $E_{cell} < 0$, then it is spontaneous reaction
   (D) Cathode is positive terminal

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

Key: Answer (2)

Sol:
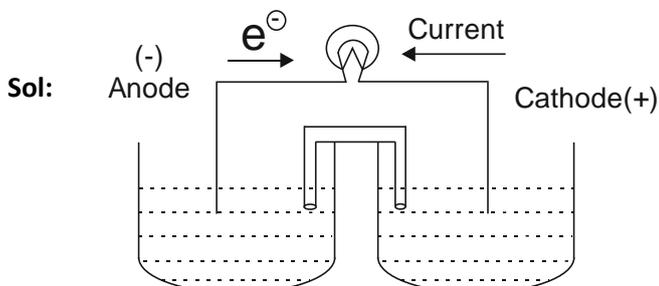
$\Delta G = -nFE_{cell}$

(for spontaneous, $E_{cell} = +ve$)

60. The electronic conductance depends on

   (1) The number of valence electrons per atom
   (2) Concentration of the electrolyte
   (3) Size of the ions
   (4) Nature of electrolyte added

Key: Answer (1)

Sol: Electronic conductors are called as metallic conductors

   ∴ No of electrons per atom is the answer

❏ ❏ ❏