Analytical Chemistry

Question1

A reagent which gives brilliant red precipitate with Nickel ions in basic medium is
[29-Jan-2024 Shift 2]

Options:

A. sodium nitroprusside

B. neutral $FeCl_3$

C. meta-dinitrobenzene

D. dimethyl glyoxime

Answer: D

Solution:

$Ni^{2+} + 2dmg^{-} \longrightarrow [Ni(dmg)_2]$
Rosy red/Bright Red precipitate

Question2

On passing a gas, ' X ', through Nessler's reagent, a brown precipitate is obtained. The gas ' X ' is
[29-Jan-2024 Shift 2]

Options:

A. H_2S

B. CO_2

C. NH_3

D. Cl_2

Answer: C

Solution:

Solution:
Nessler's Reagent Reaction :

$$\underset{\text{(Nessler's Reagent)}}{2K_2HgI_4} + NH_3 + 3\,KOH \longrightarrow \underset{\text{Iodine of Millon's base Brown precipitate}}{HgO \cdot Hg(NH_2)\,I} + 7\,KI + 2H_2O$$

Question3

The oxidation number of iron in the compound formed during brown ring test for NO_3^- ion is___
[29-Jan-2024 Shift 2]

Answer: 1

Solution:

Solution:
$[Fe(H_2O)_5(NO)]^{2+}$,
Oxidation no. of Fe = +1

Question4

The Lassiagne's extract is boiled with dil HNO_3 before testing for halogens because,
[30-Jan-2024 Shift 1]

Options:

A. AgCN is soluble in HNO_3

B. Silver halides are soluble in HNO_3

C. Ag_2S is soluble in HNO_3

D. Na_2S and NaCN are decomposed by HNO_3

Answer: D

Solution:

Solution:
If nitrogen or sulphur is also present in the compound, the sodium fusion extract is first boiled with concentrated nitric acid to decompose cyanide or sulphide of sodium during Lassaigne's test

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Question5

Given below are two statements:

Statement-I: The gas liberated on warming a salt with dil H_2SO_4, turns a piece of paper dipped in lead acetate into black, it is a confirmatory test for sulphide ion.
Statement-II: In statement-I the colour of paper turns black because of formation of lead sulphite. In the light of the above statements, choose the most appropriate answer from the options given below:
[30-Jan-2024 Shift 1]

Options:

A. Both Statement-I and Statement-II are false

B. Statement-I is false but Statement-II is true

C. Statement-I is true but Statement-II is false

D. Both Statement-I and Statement-II are true.

Answer: A

Solution:

$$Na_2S + H_2SO_4 \longrightarrow Na_2SO_4 + H_2S$$
$$(CH_3COO)_2Pb + H_2S \longrightarrow \underset{\text{Black lead sulphide}}{PbS} + 2CH_3COOH$$

Question6

Number of metal ions characterized by flame test among the following is_____
Sr^{2+}, Ba^{2+}, Ca^{2+}, Cu^{2+}, Zn^{2+}, Co^{2+}, Fe^{2+}
[30-Jan-2024 Shift 2]

Answer: 4

Solution:

All the following metal ions will respond to flame test.
Sr^{2+}, Ba^{2+}, Ca^{2+}, Cu^{2+}

Question7

The compound that is white in color is
[31-Jan-2024 Shift 1]

Options:

A. ammonium sulphide

B. lead sulphate

C. lead iodide

D. ammonium arsinomolybdate

Answer: B

Solution:

Lead sulphate-white
Ammonium sulphide-soluble
Lead iodide-Bright yellow
Ammonium arsinomolybdate-yellow

Question8

Molar mass of the salt from NaBr, $NaNO_3$, KI and CaF_2 which does not evolve coloured vapours on heating with concentrated H_2SO_4 is _____$gmol^{-1}$, (Molar mass in $gmol^{-1}$: Na : 23, N : 14, K : 39, O : 16, Br : 80, I : 127, F : 19, Ca : 40
[31-Jan-2024 Shift 1]

Answer: 78

Solution:

CaF_2 does not evolve any gas with concentrated H_2SO_4.
NaBr$\longrightarrow$ evolve Br_2
$NaNO_3\longrightarrow$ evolve NO_2
KI$\longrightarrow$ evolve I_2

Question9

Which of the following cannot function as an oxidising agent?
[27-Jan-2024 Shift 2]

Options:

A. N^{3-}

B. SO_4^{2-}

C. BrO_3^-

D. MnO_4^-

Answer: A

Solution:

In N^{3-} ion ' N ' is present in its lowest possible oxidation state, hence it cannot be reduced further because of which it cannot act as an oxidizing agent.

Question10

Chlorine undergoes disproportionation in alkaline medium as shown below :

a $Cl_2(g) + bOH^-(aq) \rightarrow cClO^-(aq) + dCl^-(aq) + eH_2O(l)$

The values of a, b, c and d in a balanced redox reaction are respectively :

[29-Jan-2024 Shift 1]

Options:

A. 1, 2, 1 and 1

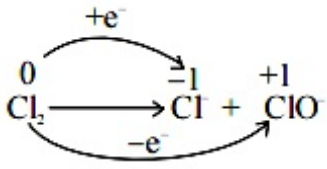
B. 2, 2, 1 and 3

C. 3, 4, 4 and 2

D. 2, 4, 1 and 3

Answer: A

Solution:



$$\Rightarrow Cl_2 + 2\overline{O}H \rightarrow Cl^- + ClO^- + H_2O$$

Question11

$KMnO_4$ decomposes on heating at 513K to form O_2 along with

[29-Jan-2024 Shift 1]

Options:

A. $MnO_2 \& K_2O_2$

B. K_2MnO_4 & Mn

C. Mn&KO_2

D. K_2MnO_4&MnO_2

Answer: D

Solution:

Solution:

$$KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$$

Question12

If 50 mL of 0.5M oxalic acid is required to neutralise 25 mL of NaOH solution, the amount of NaOH in 50 mL of given NaOH solution is ____g. [29-Jan-2024 Shift 2]

Answer: 4

Solution:

Equivalent of Oxalic acid = Equivalents of NaOH

$50 \times 0.5 \times 2 = 25 \times M \times 1$

$M_{NaOH} = 2M$

W_{NaOH} in 50 ml $= 2 \times 50 \times 40 \times 10^{-3}g = 4g$

Question13

$2MnO_4^- + bI^- + cH_2O \rightarrow xI_2 + yMnO_2 + zOH^-$

If the above equation is balanced with integer coefficients, the value of z is____

[30-Jan-2024 Shift 1]

Answer: 8

Solution:

Reduction Half	Oxidation Half
$2MnO_4^- \rightarrow 2MnO_2$	$2I^- \rightarrow I_2 + 2e^-$
$2MnO_4^- + 4H_2O + 6e^- \rightarrow 2MnO_2 + 8OH^-$	$6I^- \rightarrow 3I_2 + 6e^-$

Adding oxidation half and reduction half, net reaction is

$2MnO_4^- + 6I^- + 4H_2O \rightarrow 3I_2 + 2MnO_2 + 8OH^-$

$\Rightarrow z = 8$

$\Rightarrow$ Ans 8

Question14

Total number of species from the following which can undergo disproportionation reaction_____
H_2O_2, ClO_3^-, P_4, Cl_2, Ag, Cu^{+1}, F_2, NO_2, K^+
[30-Jan-2024 Shift 2]

Answer: 6

Solution:

Solution:
Intermediate oxidation state of element can undergo disproportionation.
H_2O_2, ClO_3^-, P_4, Cl_2, Cu^{+1}, NO_2

Question15

Given below are two statements :
Statement I: S_8 solid undergoes disproportionation reaction under alkaline conditions to form S^{2-} and $S_2O_3^{2-}$
Statement II: ClO_4^-can undergo disproportionation reaction under acidic condition. In the light of the above statements, choose the most appropriate answer from the options given below :
[31-Jan-2024 Shift 2]

Options:

A. Statement I is correct but statement II is incorrect.

B. Statement I is incorrect but statement II is correct

C. Both statement I and statement II are incorrect

D. Both statement I and statement II are correct

Answer: A

Solution:

Solution:
$S_1 : S_8 + 12OH^{\ominus} \longrightarrow 4S^{2-} + 2{S_2O_3}^{2-} + 6H_2O$
$S_2 : {ClO_4}^{\ominus}$ cannot undergo disproportionation reaction as chlorine is present in it's highest oxidation state.

Question16

The number of white coloured salts among the following is .....
(A) $SrSO_4$
(B) $Mg(NH_4)PO_4$
(c) $BaCrO_4$
(D) $Mn(OH)_2$
(E) $PbSO_4$
(F) $PbCrO_4$
(G) AgBr
(H) PbI_2
(I) CaC_2O_4
(J) $[Fe(OH)_2(CH_3COO)]$
[1-Feb-2024 Shift 1]

Answer: 5

Solution:

$SrSO_4$ - white
$Mg(NH_4)PO_4$ – white
$BaCrO_4$ - yellow
$Mn(OH)_2$ - white
$PbSO_4$ - white
$PbCrO_4$ - yellow
AgBr - pale yellow
PbI_2 - yellow
CaC_2O_4 - white
$[Fe(OH)_2(CH_3COO)]$ – Brown Red

Question17

Which of the following reactions are disproportionation reactions?
(A) $Cu^{+} \longrightarrow Cu^{2+} + Cu$
(B) $3MnO_4^{2-} + 4H^{+} \longrightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$
(C) $2KMnO_4 \longrightarrow K_2MnO_4 + MnO_2 + O_2$
(D) $2MnO_4^{-} + 3Mn^{2+} + 2H_2O \longrightarrow 5MnO_2 + 4H^{+}$
Choose the correct answer from the options given below:
[1-Feb-2024 Shift 1]

Options:

A. (A), (B)

B. (B), (C), (D)

C. (A), (B), (C)

D. (A), (D)

Answer: A

Solution:

Solution:
When a particular oxidation state becomes less stable relative to other oxidation state, one lower, one higher, it is said to undergo disproportionation.
$Cu^{+} \longrightarrow Cu^{2+} + Cu$
$3MnO_4^{2-} + 4H^{+} \longrightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$

Question18

In acidic medium, $K_2Cr_2O_7$ shows oxidising action as represented in the half reaction
$Cr_2O_7^{2-} + XH^{+} + Ye^{-} \longrightarrow 2A + ZH_2O$
X, Y, Z and A are respectively are:
[1-Feb-2024 Shift 1]

Options:

A. 8, 6, 4 and Cr_2O_3

B. 14, 7, 6 and Cr^{3+}

C. 8, 4, 6 and Cr_2O_3

D. 14, 6, 7 and Cr^{3+}

Answer: D

Solution:

Solution:
The balanced reaction is,

$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$
X = 14
Y = 6
A = 7

Question19

Given below are two statements :
Statement (I) : Potassium hydrogen phthalate is a primary standard for standardisation of sodium hydroxide solution.
Statement (II) : In this titration phenolphthalein can be used as indicator.
In the light of the above statements, choose the most appropriate answer from the options given below:
[1-Feb-2024 Shift 1]

Options:

A. Both Statement I and Statement II are correct

B. Statement I is correct but Statement II is incorrect

C. Statement I is incorrect but Statement II is correct

D. Both Statement I and Statement II are incorrect

Answer: A

Solution:

Solution:
Statement (I) : Potassium hydrogen phthalate is a primary standard for standardisation of sodium hydroxide solution as it is economical and its concentration does not changes with time.
Phenophthalin can acts as indicator in acid base titration as it shows colour in pH range 8.3 to 10.1

Question20

Match the List-I with List-II :

Cations	Group reaction
P $\rightarrow$ Pb^{2+}, Cu^{2+}	(i) H_2S gas in presence of dilute HCl
Q $\rightarrow$ Al^{3+}, Fe^{3+}	(ii) $(NH_4)_2CO_3$ in presence of NH_4OH
R $\rightarrow$ Co^{2+}, Ni^{2+}	(iii) NH_4OH in presence of NH_4Cl
S $\rightarrow$ Ba^{2+}, Ca^{2+}	(iv) H_2S in presence of NH_4OH

[25-Jan-2023 Shift 1]

Options:

A. P→ i, Q → iii, R→ ii, S→ iv

B. P→ iv, Q→ ii, R→ iii, S→ i

C. P→ iii, Q→ i, R→ iv, S→ ii

D. P → i, Q→ iii, R→ iv, S→ ii

Answer: D

Solution:

Cations	Group No.	Group reagent
Pb^{-2}, Cu^{+2}	II	H_2S(g) in presence of dilHCl
Al^{+3}, Fe^{+3}	III	NH_4OH in presence of NH_4Cl
CO^{+2}, Ni^{+2}	IV	H_2S in presence of NH_4OH
Ba^{-2}, Ca^{+2}	V	$(NH_4)_2CO_3$ in presence of NH_4OH

Question21

In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis?
[30-Jan-2023 Shift 1]

Options:

A. Fe^{3+}

B. Zn^{2+}

C. Co^{2+}

D. Ni^{2+}

Answer: A

Solution:

Zn^{2+}, Co^{2+}, Ni^{2+} = IV th Group
Fe^{3+} = III rd Group

Question22

Formulae for Nessler's reagent is:

[30-Jan-2023 Shift 2]

Options:

A. KHg_2I_2

B. $KHgI_3$

C. K_2HgI_4

D. HgI_2

Answer: C

Solution:

Solution:
Nessler's reagent is K_2HgI_4.

Question23

Given below are two statements:
Statement I : Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green.
Statement II : The green colour observed is due to the formation of copper(I) metaborate.
In the light of the above statements, choose the most appropriate answer from the options given below :
[31-Jan-2023 Shift 2]

Options:

A. Both Statement I and Statement II are true

B. Statement I is true but Statement II is false

C. Both Statement I and Statement II are false

D. Statement I is false but Statement II is true

Answer: C

Solution:

Solution:
(Borax Bead Test)
On treatment with metal salt, boric anhydride forms metaborate of the metal which gives different colours in oxidising and reducing flame. For example, in the case of copper sulphate, following reactions occur.

$$CuSO_4 + B_2O_3 \xrightarrow[(\text{ Oxidising })]{\text{Non -luminous flame}} Cu(BO_2)_2 + SO_3$$

Two reactions may take place in reducing flame (Luminous flame)
(i) The blue-green $Cu(BO_2)_2$ is reduced to colourless cuprous metaborate as:

$$2\,Cu(BO_2)_2 + 2NaBO_2 + C \xrightarrow[\text{flame}]{\text{Luminous}} 2CuBO_2 + Na_2B_4O_7 + CO$$

(ii) Cupric metaborate may be reduced to metallic copper and bead appears red opaque.

$$2\,Cu(BO_2)_2 + 4NaBO_2 + 2C \xrightarrow[\text{flame}]{\text{Luminous}} 2\,Cu + 2Na_2B_4O_7 + 2\,CO$$

Question24

Formation of which complex, among the following, is not a confirmatory test of Pb^{2+} ions
[6-Apr-2023 shift 2]

Options:

A. lead chromate

B. lead iodide

C. lead nitrate

D. lead sulphate

Answer: C

Solution:

Solution:
$\because Pb(NO_3)_2$ is a soluble colourless compound so it cannot be used in confirmatory test of Pb^{+2} ion.

Question25

In the wet tests for detection of various cations by precipitation, Ba^{2+} cations are detected by obtaining precipitate of :
[13-Apr-2023 shift 2]

Options:

A. $Ba(OAc)_2$

B. $BaCO_3$

C. $BaSO_4$

D. Ba(ox) : Barium oxalate

Answer: B

Solution:

Solution:
In wet testing, $(NH_4)_2CO_3$ is used as group reagent for 5^{th} group cations (Ba^{2+}, Ca^{2+}, Sr^{2+})

$$Ba^{+2} + (NH_4)_2CO_3 \rightarrow \underset{\text{(white precipitate)}}{BaCO_3\downarrow} + NH_4^{\oplus}$$

Question26

During the qualitative analysis of salt with cation y^{2+}, addition of a reagent (X) to alkaline solution of the salt gives a bright red precipitate. The reagent (X) and the cation (y^{2+}) present respectively are : [24-Jun-2022-Shift-1]

Options:

A. Dimethylglyoxime and Ni^{2+}

B. Dimethylglyoxime and Co^{2+}

C. Nessler's reagent and Hg^{2+}

D. Nessler's reagent and Ni^{2+}

Answer: A

Solution:

Solution:
On addition of dimethylglyoxime to alkaline solution of Ni^{+2}, a bright red ppt. is obtained.
$Ni^{+2} + 2\,dmg \rightarrow [Ni(dmg)_2]^{+2}$(Bright red ppt)

Question27

Which of the following is structure of a separating funnel? [27-Jun-2022-Shift-1]

Options:

A.

B.

C.

D.

Answer: A

Solution:

Solution:
The diagram is option (A) clearly represents separating funnel which is used to separate two immiscible liquids.

Question28

Choose the correct answer from the options given below :

	List-I (Anion)		List-II
(A)	CO_3^{2-}	I.	Colourless gas which turns lead acetate paper black.
(B)	S^{2-}	II.	Colourless gas which turns acidified potassium dichromate solution green.
(C)	SO_3^{2-}	III.	Brown fumes which turns acidified KI solution containing starch blue.
(D)	NO_2^-	IV.	Colourless gas evolved with brisk effervescence, which turns lime water milky.

[27-Jun-2022-Shift-2]

Options:

A. A-III, B-I, C-II, D-IV

B. A-II, B-I, C-IV, D-III

C. A-IV, B-I, C-III, D-II

D. A-IV, B-I, C-II, D-III

Answer: D

Solution:

CO_3^{2-} : On action of dil sulphuric acid, CO_2 gas is released which turns lime water milky.

S^{2-} : On action of dil sulphuric acid, H_2S gas is released which turns lead acetate paper black.
SO_3^{2-} : On action of dil H_2SO_4, SO_2 gas is evolved which turns acidified potassium dichromate solution green.
NO_2^-: On action of dil H_2SO_4, NO_2 gas is evolved which turns KI solution containg starch blue.

Question29

A white precipitate was formed when $BaCl_2$ was added to water extract of an inorganic salt. Further, a gas ' X ' with characteristic odour was released when the formed white precipitate was dissolved in dilute HCl. The anion present in the inorganic salt is
[29-Jun-2022-Shift-2]

Options:

A. I^-

B. SO_3^{2-}

C. S^{2-}

D. NO_2^-

Answer: B

Solution:

Anion is SO_3^{-2}

$$BaSO_3 \xrightarrow{\text{dil HCl}} \underset{\text{x(gas)}}{SO_2}\uparrow$$

Gas is released with smell of burning sulphur.

Question30

Seliwanoff test and xanthoproteic test are used for the identification of and respectively.
[26 Feb 2021 Shift 2]

Options:

A. aldoses, ketoses

B. proteins, ketoses

C. ketoses, proteins

D. ketoses, aldoses

Answer: C

Solution:

Seliwanoff and xanthoproteic tests are used for the identification of ketoses and proteins respectively.
Seliwanoff test It is a chemical test which distingusihes between aldose sugars (e.g. glucose and maltose) and ketose sugars (e.g., fructose and sucrose). The test is based on the principle that, when heated with acid, ketoses are more readily dehydrated than aldoses. The reagents used in the test consist of conc. HCl and resorcinol.

$$\text{Ketoses} \xrightarrow{\text{Conc. HCl}} \text{Deep cherry red colour}$$

$$\text{Aldoses Resorcinol} \xrightarrow{\text{Conc. HCl, Resorcinol}} \text{Faint pink colour}$$

For ketoses, a deep cherry red colour is formed rapidly indicating a positive test. Xanthoproteic test It is qualitative test to detect the presence of protein soluble in a solution using HNO_3.
In this test, solution of protein is first heated with conc. HNO_3 and then the mixture is neutralised by $40\%NaOH$ solution. If the colour changes from yellow to orange, this confirms presence of a protein.

$$\text{Protein solution} \xrightarrow[\text{(ii)40\%NaOH}]{\text{(i) Conc. } HNO_3/\Delta} \text{Yellow colouration which finally changes into orange colour.}$$

Question31

Which of the following is a false statement?
[26 Feb 2021 Shift 1]

Options:

A. Carius tube is used in the estimation of sulphur in an organic compound

B. Carius method is used for the estimation of nitrogen in an organic compound

C. Phosphoric acid produced on oxidation of phosphorus present in an organic compound is precipitated as $Mg_2P_2O_7$ by adding magnesia mixture

D. Kjeldahl's method is used for the estimation of nitrogen in an organic compound

Answer: B

Solution:

Solution:
Statement (b) is false whereas all other statements are true. There are two methods for estimation of nitrogen in an organic compound which are Duma's method and Kjeldahl's method. So, the statement in option (b) is false.

Question32

Which of the following compound is added to the sodium extract before addition of silver nitrate for testing of halogens?
[25 Feb 2021 Shift 2]

Options:

A. Hydrochloric acid

B. Sodium hydroxide

C. Nitric acid

D. Ammonia

Answer: C

Solution:

Nitric acid is added to sodium extract before addition of silver nitrate for testing halogens. Because it decomposes $NaCN$ and Na_2S or else they interfere in the test. The reaction are as follows :

$$NaCN + HNO_3 \longrightarrow NaNO_3 + HCN \uparrow$$

$$\underset{\text{Sodium extract}}{Na_2S} + \underset{\text{Nitric acid}}{HNO_3} \longrightarrow NaNO_3 + H_2S \uparrow$$

Question33

Consider titration of $NaOH$ solution versus 1.25M oxalic acid solution. At the end point following burette readings were obtained.
(i) 4.5mL
(ii) 4.5mL
(iii) 4.4mL
(iv) 4.4mL
(v) 4.4mL
If the volume of oxalic acid taken was 10.0mL, then the molarity of the $NaOH$ solution is ..... M. (Rounded off to the nearest integer)
[25 Feb 2021 Shift 2]

Answer: 6

Solution:

Solution:

Average burette reading = Volume of $NaOH$ solution (V_1)

$$= \frac{4.5 + 4.5 + 4.4 + 4.4 + 4.4}{5}$$

$$= 4.44\text{mL}$$

Strength of $NaOH$ solution $= S_1(M)$(say) $= S_1(N)$

Volume of oxalic acid solution (V_2) = 10mL

Strength of oxalic acid solution (S_2) = 1.25M

$= 1.25 \times 2N$

So, $V_1S_1 = V_2S_2$

($\because$ Law of equivalence)

$$\Rightarrow S_1 = \frac{V_2S_2}{V_1} = \frac{10 \times (1.25 \times 2)}{4.44} = 5.63N$$

$\sim$ eq6M $= 6M$

Note n-factor of $NaOH = 1$

n-factor of $H_2C_2O_4 = 2$ (oxalic acid)

$N = M \times n$

Question34

0.4g mixture of $NaOH$, Na_2CO_3 and some inert impurities was first

titrated with $\frac{N}{10}HCl$ using phenolphthalein as an indicator, 17.5mL of HCl was required at the end point. After this methyl orange was added and titrated. 1.5mL of same HCl was required for the next end point. The weight percentage of Na_2CO_3 in the mixture is ..... (Rounded off to the nearest integer).
[25 Feb 2021 Shift 1]

Answer: 4

Solution:

Solution:
As given, $NaOH$ and Na_2CO_3 is titrated with $N/10HCl$.
For $NaOH$,
Equivalents of $NaOH$ = Equivalents of HCl
Equivalents of HCl = Normality × Volume (L)
$= 0.1 \times \frac{17.5}{1000}$
Equivalent of $HCl = 1.75 \times 10^{-3}$
Equivalents of $NaOH = 1.75 \times 10^{-3}$
Weight of $NaOH$ = Equivalent of $NaOH$ × equivalent weight of $NaOH$
$= 40 \times 1.75 \times 10^{-3} = 0.07g$
Now, weight % of $NaOH$
$= \frac{0.07}{0.4} \times 100 = \frac{70}{4} = 17.5\%$
Similarly for Na_2CO_3,
Equivalent of HCl = Equivalent of Na_2CO_3
Equivalent of $Na_2CO_3 = 0.1 \times \frac{1.5}{1000}$
$= 0.15 \times 10^{-3}$
Weight of Na_2CO_3 = Equivalent of Na_2CO_3 × equivalent weight of Na_2CO_3
$= 0.15 \times 10^{-3} \times 106 = 15.9 \times 10^{-3}g$
Weight \% of $Na_2CO_3 = \frac{15.9 \times 10^{-3}}{0.4} \times 100$
$= 0.039 \times 100 = 3.9\% \sim eq4\%$

Question35

The reaction of cyanamide, $NH_2CN(s)$ with oxygen was run in a bomb calorimeter and ΔU was found to be $-742.24kJ\,mol^{-1}$. The magnitude of ΔH_{298} for the reaction $NH_2CN(s) + \frac{3}{2}O_2(g) \longrightarrow N_2(g) + O_2(g) + H_2O(l)$ is ..... kJ (Rounded off to the nearest integer).
[Assume ideal gases and
$R = 8.314J\,mol^{-1}K^{-1}$]
[25 Feb 2021 Shift 1]

Answer: 741

Solution:

Solution:

$\Delta U = -742.24 \text{kJ mol}^{-1}$

$\Delta n_g =$ [Number of gaseous molecules of products - Number of gaseous molecules of reactants]

$NH_2CN(s) + \frac{3}{2}O_2(g) \longrightarrow N_2(g) + O_2(g) + H_2O(l)$

$\Delta n_g = 2 - \frac{3}{2} = \frac{1}{2}$

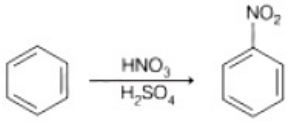
$\Delta H = \Delta U + \Delta n_g RT$

$= -742.24 + \frac{1}{2} \times \frac{8.314}{1000} \times 298$

$= -741 \text{kJ / mol}$

Hence, answer is 741 .

Question36



In the above reaction 3.9g of benzene on nitration gives 4.92g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is ..... %
(Round off to the nearest integer). (Given, atomic mass C : 12.0u, H : 1.0u, O : 16.0u, N : 14.0u)
[2021,17 March Shift-I]

Answer: 80

Solution:

Solution:

$C_6H_6 \xrightarrow[H_2SO_4]{HNO_3} C_6H_5NO_2 (\text{ Molar mass } = 123)$

Moles of $C_6H_6 = \left(\frac{3.9}{78}\right) = 0.05$

So, moles of $C_6H_5NO_2$ formed should be $\frac{3.9}{78}$.

Mass of $C_6H_5NO_2 =$ Moles × Molar mass

$= \frac{3.9}{78} \times 123 = 6.15\text{g}$

By conserving moles of carbon, mole or $C_6H_5NO_2$.

% yield $= \frac{\text{Weight actually formed}}{\text{Weight theoretical}} \times 100$

$= \frac{4.92}{6.15} \times 100 = 80\%$

Question37

In Duma's method of estimation of nitrogen, 0.1840g of an organic compound gave 30mL of nitrogen collected at 287K and 758mm of Hg pressure. The percentage composition of nitrogen in the compound is (Round off to the nearest integer).
[Given: Aqueous tension at 287K = 14mm of Hg]
[2021, 16 March Shift-II]

Answer: 19

Solution:

Solution:
Given, mass of organic compound 0.1840g
Total pressure = 758mm of Hg
Aqueous tension = 14mm of Hg
Partial pressure of dry N_2 = 758 − 14
= 744mm of Hg
For N_2
V = 30mL = 0.03L
T = 287K
p = 744mm of Hg = $\frac{744}{760}$atm
So, moles of N_2(n) = $\frac{pV}{RT} = \frac{744}{760} \times \frac{0.03}{0.0821 \times 287}$
$n = 1.25 \times 10^{-3}$ moles of N_2
Weight of N_2 = Moles × Molar mass
$= 1.25 \times 10^{-3} \times 28$
$= 35 \times 10^{-3}$g
% composition of N_2
$= \frac{\text{Mass of } N_2}{\text{Mass of organic compound}} \times 100$
$= \frac{35 \times 10^{-3}}{0.1840} \times 100$
= 19.02%

Question38

In Tollen's test for aldehyde, the overall number of electron(s) transferred to the Tollen's reagent formula $[Ag(NH_3)_2]^+$ per aldehyde group to form silver mirror is (Round off to the nearest integer).
[18 Mar 2021 Shift 2]

Answer: 2

Solution:

When an aldehyde is heated with freshly prepared Tollen's reagent i.e. $[Ag(NH_3)_2]^+$, a bright silver mirror of Ag is

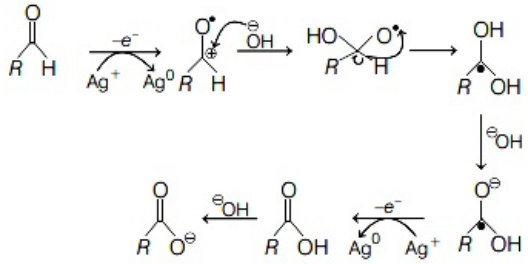
formed.

$AgNO_3 + NaOH \longrightarrow AgOH + NaNO_3$

$2AgOH \longrightarrow Ag_2O + H_2O$

$Ag_2O + 4NH_3 + H_2O \longrightarrow \underset{\text{Tollen's reagent}}{2Ag(NH_3)_2^+} + 2OH^-$

Reaction of aldehyde with Tollen's reagent take place as follows



Total $2e^-$transfer to Tollen's reagent.

Question39

Which one of the following tests used for the identification of functional groups in organic compounds does not use copper reagent? [27 Aug 2021 Shift 2]

Options:

A. Barfoed's test

B. Seliwanoff's test

C. Benedict's test

D. Biuret test for peptide bond

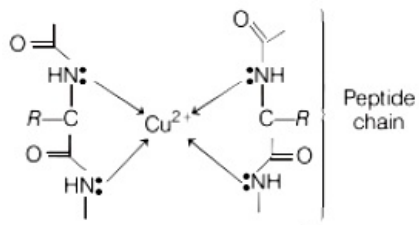
Answer: B

Solution:

Barfoed's test is used to detect monosaccharides.
In this test, the aldehyde group of monosaccharides reduces $Cu(II)$ acetate to $Cu(I)$ oxide which result in the formation of brick red ppt.

$RCHO + 2Cu^{2+} + H_2O \rightarrow RCOOH + \underset{\text{(ppt.)}}{CuO} \downarrow + 4H^+$

Benedict's test is used to test the presence of reducing sugar. Copper (II) sulphate is used in Barfoed's test.
Biuret test is used to test the presence of peptide bond. The biuret reagent contains hydrated copper sulphate, sodium hydroxide and Rochelle salt (sodium-potassium tartarate). When the aqueous, solution of protein is treated with this reagent, the solution turns purple confirming the presence of amide bond.



Chelated complex of Cu^{2+} ions formed gives purple colour to the solution.
So, correct answer is option (b) Seliwanoff's test which is used to distinguish between ketoses and aldoses. The Seliwanoff's reagent contains resorcinol and HCl.

Question40

When 10 mL of an aqueous solution of $KMnO_4$ was titrated in acidic medium, equal volume of 0.1M of an aqueous solution of ferrous sulphate was required for complete discharge of colour.
The strength of $KMnO_4$ in g / L is..... $\times 10^{-2}$. (Nearest integer)
[Atomic mass of K = 39, Mn = 55, O = 16]
[27 Aug 2021 Shift 1]

Answer: 316

Solution:

Let molarity of $KMnO_4$ = x

$KMnO_4 + FeSO_4 \rightarrow Fe(SO_4)_3 + Mn^{2+}$

n = 5 n = 1

(Equivalent of $KMnO_4$ reacted) = (Equivalent of $FeSO_4$ reacted)

$5x \times 10 = 1 \times 0.1 \times 10$

x = 0.02 M

Molar mass of $KMnO_4$ = 158g / mol

Strength = $x \times 158 = 0.02 \times 158 = 3.16$g / L

$\therefore x \approx 316$.

Question41

The OH^- concentration in a mixture of 5.0 mL of 0.0504MNH_4Cl and 2 mL of 0.0210MNH_3 solution is $x \times 10^{-6}$M. The value of x is (Nearest integer)
[Given, $K_w = 1 \times 10^{-14}$ and $K_b = 1.8 \times 10^{-5}$]
[26 Aug 2021 Shift 1]

Answer: 3

Solution:

Solution:

Number of moles of NH_4Cl = concentration of $NH_4Cl \times$ volume of NH_4Cl

$= 0.0504M \times 5\,mL = 0.2520$ millimoles

Total volume of solution in mixture

= Volume of NH_4Cl solution + volume of NH_3solution

$= 5 + 2 = 7\,mL$

Concentration of NH_4Cl in mixture

$$= \frac{\text{Number of moles of } NH_4Cl}{\text{Total volume}}$$

$$= \frac{0.2520\,\text{millimole}}{7\,mL} = 0.036M$$

$\text{Number of moles of } NH_3 = \text{concentration of } NH_3 \times \text{volume of } NH_3$

$= 0.0210 \times 2 = 0.042$ millimole

Concentration of NH_3 in mixture $= \frac{\text{Number of moles of } NH_3}{\text{Total volume}}$

$= \frac{0.042}{7} = 0.006M$

According to Handerson's equation

$pOH = pK_b + \log \frac{[Salt]}{[Base]}$

$[Salt] = [NH_4Cl]$

$[Base] = [NH_3]$

$pOH = -\log K_b + \log \frac{0.036}{0.006}$

$pOH = -\log(1.8 \times 10^{-5}) + 0.7782$

$pOH = 5.523$

$\because pOH = -\log[OH^-]$

So, $[OH^-] = 2.9 \times 10^{-6} \approx 3 \times 10^{-6}$

$\therefore x = 3$

Question42

Given below are two statements.
Statement I In the titration between strong acid and weak base methyl orange is suitable as an indicator.
Statement II For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.
In the light of the above statements, choose the most appropriate answer from the options given below.
[26 Aug 2021 Shift 1]

Options:

A. Statement I is false but statement II is true.

B. Statement I is true but statement II is false.

C. Both statement I and statement II are true.

D. Both statement I and statement II are false.

Answer: B

Solution:

Solution:
In the titration of strong acid with the weak base methyl orange is an suitable indicator. Initially, pH of weak base is high, as acid is added pH falls slowly and equivalence point is attained.
(Equivalence point is point when chemical equivalentquantities of acid and base are mixed). After equivalence point pH falls sharply. So, methyl orange having pH range $3.2 - 4.4$ will work as suitable indicator. Methyl orange shows red colour in acidic medium and yellow colour in basic medium.
Hence, statement I is true.
In titration of weak acid and strong base initially pH of weak acid is below 7. As strong base is added pH increases slowly and equivalence point is attained. After equivalence point pH abruptly increases. So, phenolphthalein having pH range $8.2 - 10.0$ will work as suitable indicator. Phenolphthalein is colourless in acidic solution whereas pink in basic solution.
Hence, statement II is false.

Question43

An inorganic Compound 'X' on treatment with concentrated H_2SO_4 produces brown fumes and gives dark brown ring with $FeSO_4$ in presence of concentrated H_2SO_4. Also Compound ' X ′ gives precipitate 'Y', when its solution in dilute HCl is treated with H_2S gas. The precipitate ' Y ′ on treatment with concentrated HNO_3 followed by excess of NH_4OH further gives deep blue coloured solution, Compound ' X ′ is:
[20 Jul 2021 Shift 1]

Options:

A. $Co(NO_3)_2$

B. $Pb(NO_2)_2$

C. $Cu(NO_3)_2$

D. $Pb(NO_3)_2$

Answer: C

Solution:

$$\underset{X(\text{Anion})}{NO_3^-} + \underset{(\text{Conc.})}{H_2SO_4} \rightarrow \underset{\text{Brown fumes}}{NO_2\uparrow} + H_2O$$

$$\underset{\text{Sol}^n}{FeSO_4} + \underset{\text{conc.}}{H_2SO_4} + \underset{X}{NO_3^-}$$

$$\downarrow$$

$$[Fe(H_2O)_5(NO)]SO_4$$

(Dark brown ring)

$$\underset{X}{Cu^{2+}} + (\text{dil HCl} + H_2S)$$

(cation) (Group-II reagent)

$$\downarrow$$

$$CuS\downarrow$$

(Black ppt)

(Y)

$$\underset{(Y)}{CuS} \xrightarrow[HNO_3]{\text{Conc}^n} \overset{\text{Soluble}}{Cu(NO_3)_2} + NO_2 + S + H_2O$$

$$\downarrow \text{Excess } NH_4OH \text{ Sol}^n.$$

$$[Cu(NH_3)_4]^{2+}$$

Deep blue colour solution.

$$\therefore X \rightarrow Cu(NO_3)_2$$

Question44

When silver nitrate solution is added to potassium iodide solution then

the sol produced is :
[22 Jul 2021 Shift 2]

Options:

A. $AgI\ /\ I^-$

B. $AgI\ /\ Ag^+$

C. $KI\ /\ NO_3^-$

D. $AgNO_3\ /\ NO_3^-$

Answer: A

Solution:

$$\underset{\text{(drop by drop)}}{AgNO_3(aq.)} + \underset{\text{excess}}{KI(aq.)} \rightarrow \underset{\text{Sol}}{AgI\ /\ I^-}$$

Question45

To an aqueous solution containing ions such as Al^{3+}, Zn^{2+}, Ca^{2+}, Fe^{3+}, Ni^{2+}, Ba^{2+} and Cu^{2+} was added conc. HCl, followed by H_2S. The total number of cations precipitated during this reaction is/are :
[27 Jul 2021 Shift 2]

Options:

A. 1

B. 3

C. 4

D. 2

Answer: A

Solution:

Solution:
Al^{3+} and Fe^{3+} sulphides hydrolyse in water.
Ni^{2+} and Zn^{2+} require basic medium with H_2S to form ppt
Ca^{2+} and Ba^{2+} sulphides are soluble
hence we will receive only CuS ppt.

Question46

Which one of the following set of elements can be detected using

sodium fusion extract ?
[27 Jul 2021 Shift 2]

Options:

A. Sulfur, Nitrogen, Phosphorous, Halogens

B. Phosphorous, Oxygen, Nitrogen, Halogens

C. Nitrogen, Phosphorous, Carbon, Sulfur

D. Halogens, Nitrogen, Oxygen, Sulfur

Answer: A

Solution:

Solution:
By sodium fusion extract we can detect sulphur, nitrogen,
Phosphorous and halogens, because they are converted in to their ionic form with sodium metal.

Question47

Match List-I with List-II.

List-I (Test / Reagents / Observation(s))	List-II (Species detected)
A. Lassaigne's test	(i) Carbon
B. Cu(II) oxide	(ii) Sulphur
C. Silver nitrate	(iii) N,S,P, and halogen
D. The sodium fusion extract gives black precipitate with acetic acid and lead acetate	(iv) Halogen specifically

The correct match is
[2021]

Options:

A. A-(iii), B-(i), C-(ii), D-(iv)

B. A-(i), B-(iv), C-(iii), D-(ii)

C. A-(iii), B-(i), C-(iv), D-(ii)

D. A-(i), B-(ii), C-(iv), D-(iii)

Answer: C

Solution:

Solution:
(A) Lassaigne test is used to detect N , S, P, X elements.
The elements present in the compound are converted from covalent form into the ionic form by fusing the compound with sodium metal. Following reactions take place.

$Na + C + N \xrightarrow{\Delta} NaCN$

$2Na + S \xrightarrow{\Delta} Na_2S$

$Na + X \xrightarrow{\Delta} NaX \quad (X = Cl, Br \text{ or } I)$

(B) Carbon and hydrogen are detected by heating the compound with copper (II) oxide.

$C + 2CuO \longrightarrow 2Cu + CO_2$

$2H + CuO \longrightarrow Cu + H_2O$

(C) Halides are detected by silver nitrate.

They form precipitate of AgX except fluorine.

$Ag^+(aq) + X^-(aq) \longrightarrow AgX(s)$

(D) Sodium fusion extract gives black precipitate of PbS with acetic acid and lead acetate to confirm the presence of sulphur.

$Na_2S + (CH_3COO)_2Pb \longrightarrow \underset{\text{Black ppt.}}{PbS} + 2CH_3COONa^2$

Question48

A, B and C are three biomolecules. The results of the tests performed on them are given below:

	Molisch's Test	BarfoedTest	Biuret Test
A	Positive	Negative	Negative
B	Positive	Positive	Negative
C	Negative	Negative	Positive

A, B and C are respectively:
[Jan. 09, 2020 (II)]

Options:

A. A = Glucose, B = Fructose, C = Albumin

B. A = Lactose, B = Glucose, C = Albumin

C. A = Lactose, B = Glucose, C = Alanine

D. A = Lactose, B = Fructose, C = Alanine

Answer: B

Solution:

Solution:
Molisch's test is used to check the presence of carbohydrates while Barfoed test is used for detecting the monosaccharides. Biuret test is used to detect the peptide bonds. Therefore, A and B (monosaccharide) are carbohydrates while C is a protein.

Question49

The strength of an aqueous NaOH solution is most accurately determined by titrating: (Note: consider that an appropriate indicator is used)
[Jan. 08, 2020 (I)]

Options:

A. Aq. $NaOH$ in a pipette and aqueous oxalic acid in a burette

B. Aq. $NaOH$ in a burette and aqueous oxalic acid in a conical flask

C. Aq. $NaOH$ in a burette and concentrated H_2SO_4 in a conical flask

D. Aq. $NaOH$ in a volumetric flask and concentrated H_2SO_4 in a conical flask

Answer: B

Solution:

Solution:
Oxalic acid is a primary standard solution whereas H_2SO_4 is a secondary standard solution. So it does not matter whether oxalic acid is taken in a burette or in conical flask. Therefore accurate measurement of concentration by titration depends on the nature of the solution.

Question50

Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?
[Jan. 08,2020(II)]

Options:

A. $C_6H_5NH_2$

B. CH_3CH_2-C+N

C. $C_6H_5NO_2$

D. NH_2-C-NH_2

Answer: C

Solution:

Solution:
Kjeldahl's method can not be used for nitrogen determination of compounds having nitro group or azo group or nitrogen present in rings as the nitrogen of these compounds can not be converted to $(NH_4)_2SO_4$ under the condition of this method.

Question51

A solution of m -chloroaniline, m -chlorophenol and m chlorobenzoic acid in ethyl acetate was extracted initially with a saturated solution of $NaHCO_3$ to give fraction A. The left over organic phase was extracted with dilute NaOH solution to give fraction B. The final organic layer was labelled as fraction C. Fractions A, B and C, contain respectively:

[Jan. 07, 2020 (I)]

Options:

A. m -chlorobenzoic acid, m -chloroaniline and m -chlorophenol

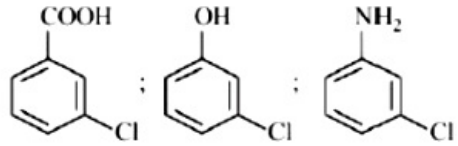
B. m -chlorobenzoic acid, m -chlorophenol and m -chloroaniline

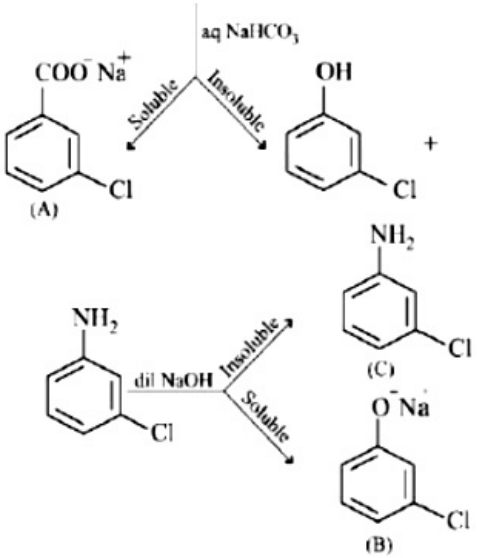
C. m -chlorophenol, m -chlorobenzoic acid and m -chloroaniline

D. m -chloroaniline, m -chlorobenzoic acid and m -chlorophenol

Answer: B

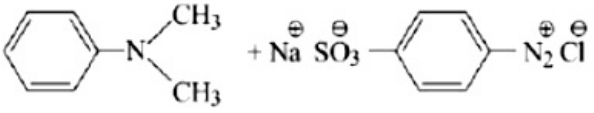
Solution:





Question52

Consider the following reaction:



· X

The product ' X is used:
[Jan. 07,2020(I)]

Options:

A. in protein estimation as an alternative to ninhydrin

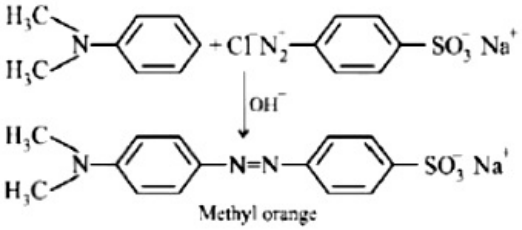
B. in acid base titration as an indicator

C. as food grade colourant

D. in laboratory test for phenols

Answer: B

Solution:



Methyl orange is used as an indicator in acid base titrations.

Question53

A chromatography column, packed with silica gel as stationary phase, was used to separate a mixture of compounds consisting of (A) benzanilide (B) aniline and (C) acctophenone. When the column is eluted with a mixture of solvents, hexane: ethyl acetate (20 : 80), the sequence of obtained compounds is:
[Jan. 07,2020 (II)]

Options:

A. (B), (C) and (A)

B. (B), (A) and (C)

C. (C), (A) and (B)

D. (A), (B) and (C)

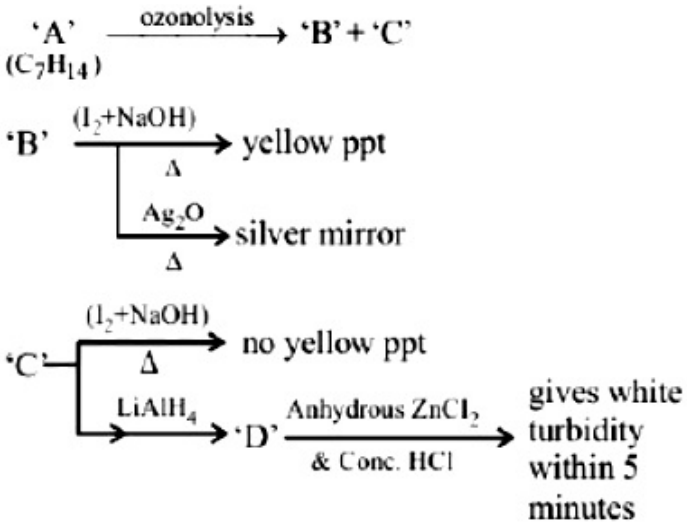
Answer: C

Solution:

Solution:
Compounds which are able to form strong H-bond with the stationary phase (silica gel) will come last with the mobile phase.
H-bonding order:
aniline > benzanilide > acetophenone
B > A > C
∴ Sequence of obtained compounds is (C, A, B)

Question54

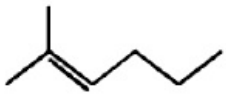
Consider the following reactions:



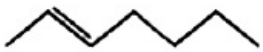
'A' is :
[Sep. 06, 2020 (I)]

Options:

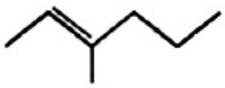
A.



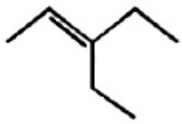
B.



C.

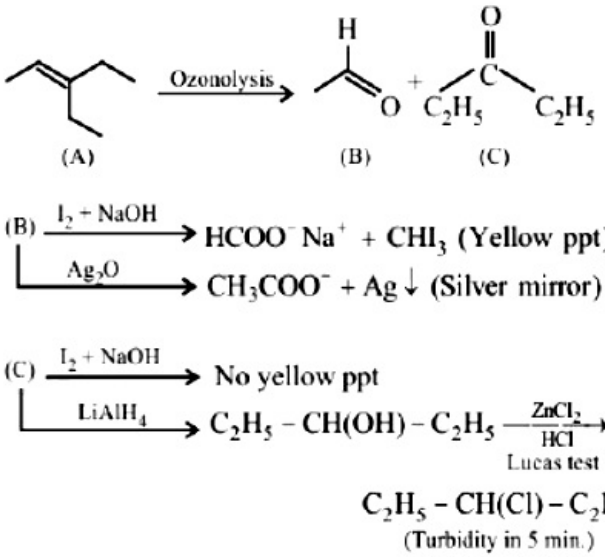


D.



Answer: D

Solution:



Question55

Match the following:

Column-I	Column-II
Test / Method	**Reagent**
(i) Lucas Test	(A) $C_6H_5SO_2Cl / aq \cdot KOH$
(ii) Dumans method	(B) $HNO_3 / AgNO_3$
(iii) Kjeldahl's method	(C) CuO / CO_2
(iv) Hinsberg Test	(D) Conc. HCl and $ZnCl_2$
	(E) H_2SO_4

[Sep. 06,2020(11)]

Options:

A. (I) − (D), (II) − (C), (III) − (B), (IV) − (A)

B. (I) − (B), (II) − (D), (III) − (E), (IV) − (A)

C. (I) − (D), (II) − (C), (III) − (E), (IV) − (A)

D. (I) − (B), (II) − (A), (III) − (C), (IV) − (D)

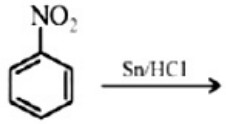
Answer: C

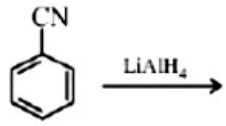
Solution:

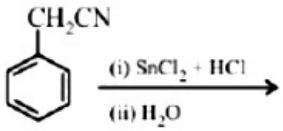
(I) Lucas reagent - Conc. HCl / $ZnCl_2$
(II) Dumas method $-CuO$ / CO_2
(III) Kjeldahl's method $-H_2SO_4$
(IV) Hinsberg test - $C_6H_5SO_2Cl$ / aq . KOH

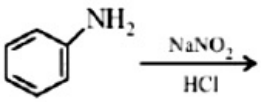
Question56

The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products?









[Sep. 03,2020(I)]

Options:

A. (3) and (4)

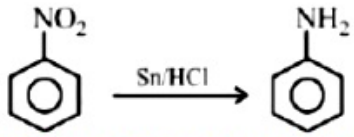
B. (1) and (4)

C. (1), (3) and (4)

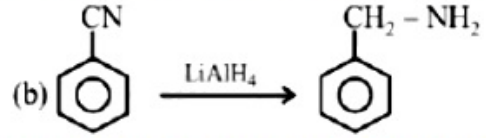
D. (2) and (3)

Answer: A

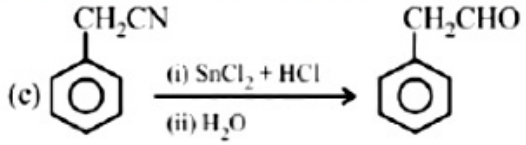
Solution:



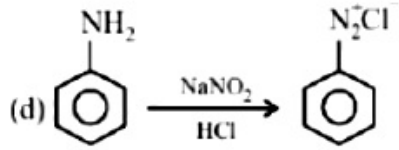
(Product will give positive Kjeldhal test due to presence of $-NH_2$ group)



(N-present in product so it will show Kjeldhal Test) (c) (d)



(N-absent)



($-N_2^+$ Never show Kjeldhal test)

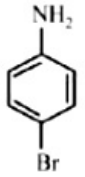
Question57

In Carius method of estimation of halogen, 0.172g of an organic compound showed presence of 0.08g of bromine. Which of these is the correct structure of the compound?
[Sep.02,2020(I)]

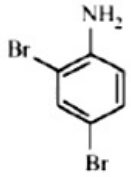
Options:

A. $H_3C - CH_2 - Br$

B.



C.



D. $H_3C - Br$

Answer: B

Solution:

Solution:

Mole of bromine $= \frac{0.08}{80} = 10^{-3}$ mole

Molar mass of compound is given by the following equation,

$\frac{0.172}{M} = 10^{-3}$

$\Rightarrow M = \frac{0.172}{10^{-2}} = 172g$

$\because$ Molar mass of C_6H_6NBr

$= (6 \times 12) + (1 \times 6) + (1 \times 14) + (1 \times 80) = 172g$

Thus option (b) is the correct structure of compound.

Question58

While titrating dilute HCl solution with aqueous NaOH, which of the following will not be required?
[Sep. 02,2020(I)]

Options:

A. Burette and porcelain tile

B. Pipette and distilled water

C. Clamp and phenolphthalein

D. Bunsen burner and measuring cylinder

Answer: D

Solution:

Solution:
In this acid base titration bunsen burner and measuring cylinder are of no use while other laboratory equipments will be required i.e., phenol phthalein, burette and pipette.

Question59

If you spill a chemical toilet cleaning liquid on your hand, your first aid would be:
[Sep. 02,2020 (II)]

Options:

A. vinegar

B. aqueous $NaOH$

C. aqueous $NaHCO_3$

D. aqueous NH_3

Answer: C

Solution:

Solution:
In toilet cleaning liquid, the main constituent is HCl, which can cause skin burn, so it should be treated with $NaHCO_3$, which can easily neutralise the acid.

Question60

Two compounds A and B with same molecular formula (C_3H_6O) undergo Grignard's reaction with methyl-magnesium bromide to give products C and D. Products C and D show following chemical tests.

Test	C	D
Ceric ammo-niumnitrate Test	Positive	Positive
Lucas Test	Turbidity obtained afterfive minutes	Turbidity obtainedimmediately
Iodoform Test	Positive	Negative

C and D respectively are:

[Sep. 02,2020 (II)]

Options:

A. C = $H_3C-CH_2-\overset{OH}{\underset{|}{CH}}-CH_3$; D = $H_3C-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-OH$

B. C = $H_3C-CH_2-CH_2-CH_2-OH$; D = $H_3C-CH_2-\underset{OH}{\underset{|}{CH}}-CH_3$

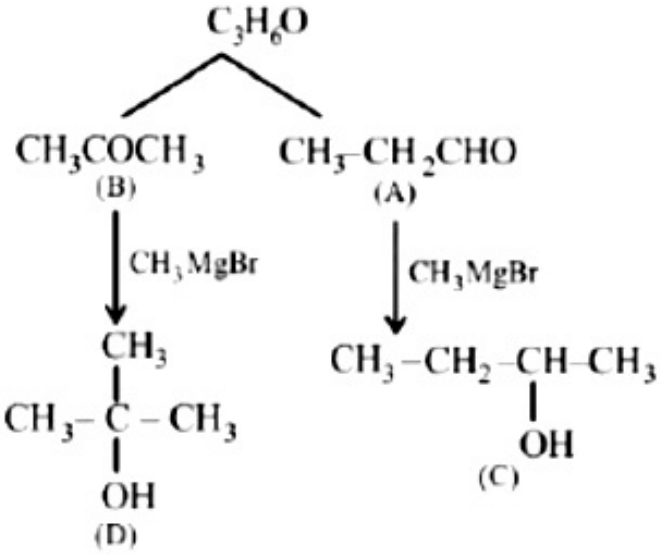
C. C = $H_3C-CH_2-CH_2-CH_2-OH$; D = $H_3C-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-OH$

D. C = $H_3C-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-OH$; D = $H_3C-CH_2-\underset{OH}{\underset{|}{C}}H-CH_3$

Answer: A

Solution:

Solution:



Test	D	C	Conformation
Iodoform Test	-ve	+ve	Presence of $R-\overset{OH}{\underset{|}{C}}H-CH_3$ group
Lucas Test	Immediate	after $5-10 Min.$	Presence of 2° & 3°, $-OH$ group
Ceric Ammonium nitrate Test	+ve	-ve	Presence of $-OH$ group

Question61

The correct match between items I and I is :

Item - I	Item - II
(Mixture)	(Separation method)
(A) H_2O: Sugar	(P) Sublimation
(B) H, O: Aniline	(Q) Recrystallization
(C) H_2O: Toluene	(R) Steam distillation
	(S) Differential extraction

[Jan. 11, 2019(I)]

Options:

A. (A) → (S); (B) → (R); (C) → (P)

B. (A) → (Q); (B) → (R); (C) → (S)

C. (A) → (R); (B) → (P); (C) → (S)

D. (A) → (Q); (B) → (R); (C) → (P)

Answer: B

Solution:

Solution:
(A) Water and sugar do not react chemically, and sugar dissolves completely in water on heating. On cooling sugar solution, sugar recrystallises back (Q). (B) Aniline is insoluble in water, but it is steam volatile. Hence it can be separated from water by steam distillation (R).
(C) Toluene is insoluble as well as non-volatile in steam. Hence they can be separated by differential attraction method (S).

Question62

An organic compound is estimated through Dumas method and was found to evolve 6 moles of CO_2, 4 moles of H_2O and 1 mole of nitrogen gas. The formula of the compound is:
[Jan. 11,2019(I)]

Options:

A. $C_{12}H_8N$

B. $C_{12}H_gN_2$

C. $C_6H_gN_2$

D. C_6H_8N

Answer: C

Solution:

$[C_xH_yN_z] \xrightarrow[\text{method}]{\text{Dumas}} 6CO_2 + 4H_2O + N_2$

Mol of CO_2 = 6, so mol of C is = 6

Mol of H_2O = 4, so mol of H is = 8

Mol of N_2 = 1, so mol of N is = 2

∴ Formula is $C_6H_3N_2$

Question63

The correct match between Item I and Item II is:

Item - I	Item - II
(A) Ester test	(P) Tyr
(B) Carbylamine test	(Q) AsP
(C) Phthalein dye test	(R) Ser
	(S) Lys

[Jan. 11,2019(II)]

Options:

A. (A) → (Q, R); (B) → (S); (C) → (P)

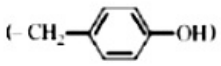
B. (A) → (R); (B) → (Q); (C) → (P)

C. (A) → (R); (B) → (S); (C) → (Q)

D. (A) → (Q); (B) → (S); (C) → (R)

Answer: A

Solution:

Name	Abrevations	Functional group	Test
(P) Tyrosine	Tyr		Phthalein dye test (*C*)
(Q) Aspartic acid	Asp	$(-CH_2COOH)$	Ester test (A)
(R) Serine	Ser	$(-CH_2OH)$	Ester test (A)
(S) Lysine	Lys	$(-(CH_2)_4-NH_2)$	Carbylaminetest (B)

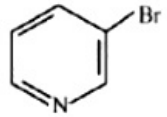
Question64

Which of the following compounds will produce a precipitate with $AgNO_3$?

[Jan. 11, 2019(II)]

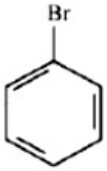
Options:

A.

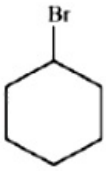


B.

C.



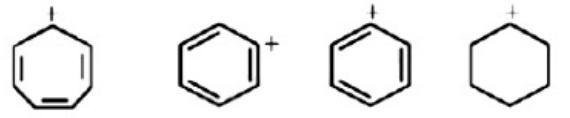
D.



Answer: B

Solution:

Solution:
Only those halides give precipitate with $AgNO_3$ which easily ionises to give halide ion and a stable carbocation. Corresponding carbocation from the four bromides are



Question65

If dichloromethane (DCM) and water (H_2O) are used for differential extraction, which one of the following statements is correct? [Jan. 10, 2019(I)]

Options:

A. DCM and H_2O would stay as lower and upper layer respectively in the S.F.

B. DCMand H_2O will make tur bid/colloidal mixture

C. DCM and H_2O would stay as upper and lower layer respectively in the separating funnel (S.F.)

D. DCM and H_2O will be miscible clearly

Answer: A

Solution:

Due to higher density of dichloromethane than water, DCM would be in the lower layer and water will form the upper layer in the separating funnel.

Question66

The correct match between item 'I' and item 'II' is:

Item - I (compound)	Item - II (reagent)
(A) Lysine	(P) 1-Naphthol
(B) Furfural	(Q) Ninhydrin
(C) Benzyl alcohol	(R) $KMnO_4$
(D) Styrene	(S) Ceric ammonium nitrate

[Jan. 10,2019 (II)]

Options:

A. (A) → (Q); (B) → (P); (C) → (S); (D) → (R)

B. (A) → (Q); (B) → (P); (C) → (R); (D) → (S)

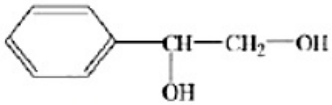
C. (A) → (R); (B) → (P); (C) → (Q) : (D) → (S)

D. (A) → (Q); (B) → (R); (C) → (S); (D) → (P)

Answer: A

Solution:

Lysine being an amino acid reacts with ninhydrin to give a coloured product (blue purple). Furfural test is used to distinguish between glucose and fructose. In this test, dilute sugar solution is added to 1 naphthol (in alcohol) and conc. HCl.
Alcohols are oxidised to aldehydes using ceric ammonium nitrate.
Styrene is converted to



using $KMnO_4$

Question67

Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:
[Jan. 10,2019 (II)]

Options:

A. sodium-ammonia complex

B. sodamide

C. sodium ion-ammonia complex

D. ammoniated electrons

Answer: D

Solution:

Solution:
Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the ammoniated electrons.

Question68

Which of the following tests cannot be used for identifying amino acids?
[Jan. 10,2019(II)]

Options:

A. Biuret test

B. Barfoed test

C. Ninhydrin test

D. Xanthoproteic test

Answer: B

Solution:

Solution:
Barfoed test is used to test the reducing nature of sugar (carbohydrate).

Question69

The correct match between Item-I and Item-II is:

Item - I (drug)	Item - II (test)
(A) Chloroxylenol	(P) Carbylamine test
(B) Norethindrone	(Q) Sodium hydrogen carbonate test
(C) Sulphapyridine	(R) Ferric chloride test
(D) Penicillin	(S) Bayer;s test

[Jan. 9,2019 (I)]

Options:

A. A → R; B → P; C → S; D → Q

B. A → Q; B → S; C → P; D → R

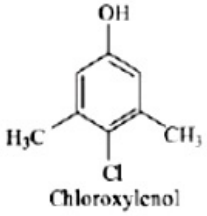
C. A → R; B → S; C → P; D → Q

D. A → Q; B → P; C → S; D → R

Answer: C

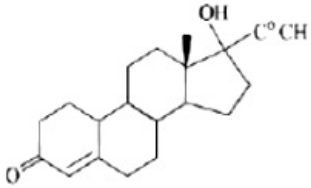
Solution:

As chloroxylenol contains phenolic group, so it gives positive ferric chloride test



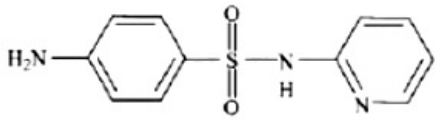
Chloroxylenol

Norethindrone has double bond, thus it will give Bayer's test.

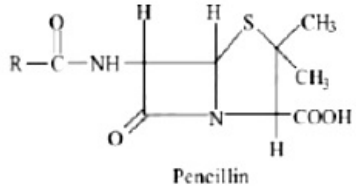


Norethindrone

Norethindrone Sulphapyridine contains $-NH_2$ group, so it gives carbylamine test.



Sulphapyridinc Penicillin contains -COOH group, so it will give sodium hydrogen carbonate ($NaHCO_3$) test.



Pencillin

Question70

The correct match between Item I and Item II is:

Item - I	Item - II
(A) Benzaldehyde	(P) Mobile phase
(B) Alumina	(Q) Adsorbent
(C) Acetonitrile	(R) Adsorbate

[Jan. 9,2019(II)]

Options:

A. (A) → (Q); (B) → (P); (C) → (R)

B. (A) → (R); (B) → (Q); (C) → (P)

C. (A) → (Q); (B) → (R); (C) → (P)

D. (A) → (P); (B) → (R); (C) → (Q)

Answer: B

Solution:

Benzaldehyde is an absorbate, alumina is an adsorbent (stationary phase) and acetonitrile is in mobile phase.

Question71

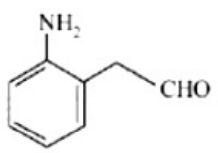
The tests performed on compound X and their inferences are:

Test	Inference
(a) $2,4-DNP$ test	Coloured precipitate
(b) Iodoform test	Yellow precipitate
(c) Azo-dye test	No dye formation

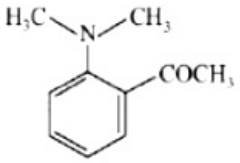
Compound 'X' is:
[Jan .9,2019(II)]

Options:

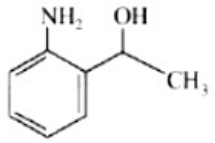
A.



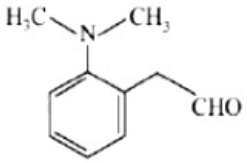
B.



C.



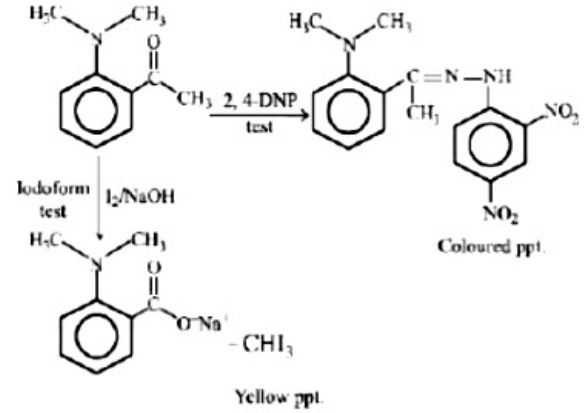
D.



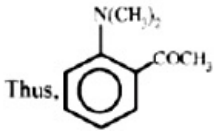
Answer: B

Solution:

Solution:
Reaction involved in the tests performed is as follows:



Thus,



will not give positive azo-dye test due to the presence of an electron-withdrawing group.

Question72

An organic compound ' A ' is oxidized with Na_2O_2 followed by boiling with HNO_3. The resultant solution is then treated with ammonium molybdate to yield a yellow precipitate. Based on above observation, the element present in the given compound is:
[April 12, 2019 (I)]

Options:

A. Nitrogen

B. Phosphorus

C. Fluorine

D. Sulphur

Answer: B

Solution:

Solution:
Phosphorus is detected in the form of yellow ppt of ammonium phosphate molybdate on reaction with ammonium molybdate.

$$\underset{(A)}{2P} + 3Na_2O_2 + O_2 \xrightarrow{\text{fusion}} 2Na_3PO_4$$

$$Na_3PO_4 + 3HNO_3 \longrightarrow H_3PO_4 + 3NaNO_3$$

$$H_3PO_4 + 12\underset{\text{(Ammoniun molybdate)}}{(NH_4)_2MoO_4} + 21HNO_3 \longrightarrow$$

$$\underset{\text{(Ammonium phosphomolybdate)}}{(NH_4)_3PO_4 \cdot 12MoO_3} \downarrow + 21NH_4NO_3 + 12H_2O$$
$$\text{(canary yellow ppt.)}$$

Question73

Which one of the following is likely to give a precipitate with $AgNO_3$ solution?
[April 12, 2019 (II)]

Options:

A. $CH_2 = CH - Cl$

B. CCl_4

C. $CHCl_3$

D. $(CH_3)_3CCl$

Answer: D

Solution:

Solution:
$(CH_3)_3C^+$ from $(CH_3)_3CCl$ is quite stable and hence easily formed and thus Cl^- ion forms white precipitate with $AgNO_3$

Question74

The principle of column chromatography is:
[April 10,2019,(I)]

Options:

A. Gravitational force.

B. Capillary action.

C. Differential absorption of the substances on the solid phase.

D. Differential adsorption of the substances on the solid phase.

Answer: D

Solution:

In column chromatograph; a solid adsorbent is packed on a column and a solution containing number of solute particles is allowed to flow down the column. The solute molecules get adsorbed on the surface of adsorbent and move through column at different rates based on differential adsorption of the substances on the solid phase.

Question75

In chromatography, which of the following statement is INCORRECT for R_r ?
[April 10,2019 (II)]

Options:

A. R_j value depends on the type of chromatography.

B. The value of R_j can not be more than one.

C. Higher R_f value means higher adsorption.

D. R_f value is dependent on the mobile phase.

Answer: C

Solution:

In chromatography, R_f represents retardation factor.

$$R_r = \frac{\text{Distance moved by the substance from baseline}}{\text{Distance moved by the solvent from baseline}}$$

$\therefore$ Higher R_f value means lower adsorption.

Question76

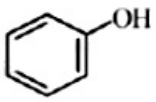
The organic compound that gives following qualitative analysis is:

Test	Inference
(a) Dil. HCl	Insoluble
(b) $NaOH$ solution	soluble
(c) Br_2/ water	Decolourization

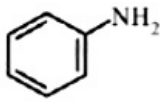
[April9,2019(I)]

Options:

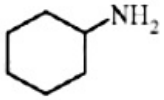
A.



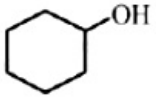
B.



C.

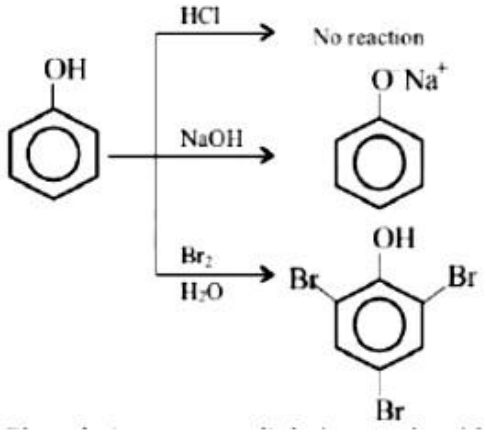


D.



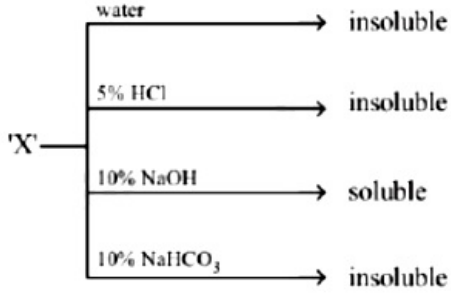
Answer: A

Solution:



Question77

An organic compound 'X' showing the following solubility profile is:



[April 8,2019 (I)]

Options:

A. o -Toluidine

B. Oleic acid

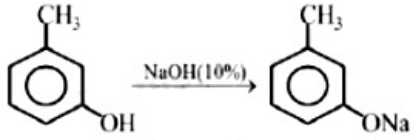
C. m -Cresol

D. Benzamide

Answer: C

Solution:

Solution:
Phenols (e.g. m -cresol), being weak acid, are soluble in dil N aOH , but insoluble in N aH CO_3.



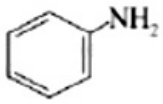
Question78

Which of the following compounds will be suitable for Kjeldahl's method for nitrogen estimation?
[2018]

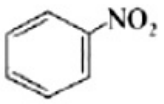
Options:

A.

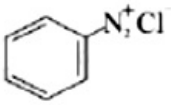
B.



C.



D.



Answer: B

Solution:

Solution:
Kjeldahl's method is not applicable for compounds containing nitrogen in nitro and azo groups and nitrogen in ring, as N of these compounds does not change to ammonium sulphate under these conditions.

Question79

An alkali is titrated against an acid with methyl orange as indicator, which of the following in a correct combination?
[2018]

Options:

A. Base →Weak
Acid→Strong
Endpoint →Colourless to pink

B. Base →Strong
Acid→Strong
Endpoint →Pinkish red to yellow

C. Base →Weak
Acid→Strong
Endpoint →Yellow to Pinkish red

D. Base →Strong
Acid→Strong
Endpoint →Pink to colourless

Answer: C

Solution:

Solution:
pH range for methyl orange is
$\longleftarrow 3.9 - 4.5 \longrightarrow$
Pinkish red Yellow
Generally, weak bases have pH greater than 7. When methyl orange is added to a weak basic solution, solution becomes yellow. This solution is then titrated against a strong acid, at the end point pH will be less than 3.1.
∴ Solution becomes pinkish red.

Question80

For standardizing $NaOH$ solution, which of the following is used as a primary standard?
[Online April 16,2018]

Options:

A. Sodium tetraborate

B. Ferrous ammonium sulfate

C. Oxalic acid

D. dil. HCl

Answer: C

Solution:

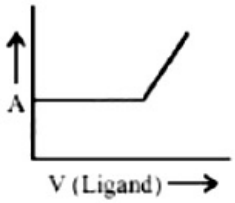
Oxalic acid is used as a primary standard for $NaOH$ standardizing.

Question81

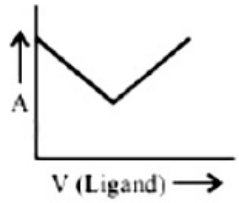
In a complexometric tritration of metal ion with ligand M(Metal ion) +L(Ligand) ⟶ C(Complex) end point is estimated spectrophotometrically (through light absorption) If'M' and 'C' do not absorb light and only 'L' absorbs, then the titration plot between absorbed light (A) versus volume of ligand 'L' (V) would look like: [Online April 16, 2018]

Options:

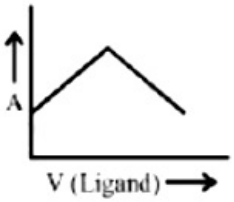
A.



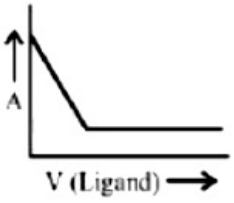
B.



C.



D.



Answer: A

Solution:

Initially ligand is consumed by metal due to formation of complex. So absorbed light (A) remain constant, after complex formation is completed, extra volume of ligand solution increases ligand concentration and also increases absorbed light.

Question82

The incorrect statement out of the following is [Online April 16, 2018]

Options:

A. Cu^{2+} ion gives chocolate coloured precipitate with potassium ferrocyanide solution

B. Cu^{2+} and Ni^{2+} ions give black precipitate with H_2S in presence of HCl solution

C. Ferric ion gives blood red colour with potassium thiocyanate

D. Cu^{2+} salts give red coloured borax bead test in reducing flame.

Answer: B

Solution:

Solution:
Due to common ion effect insufficient concentration of sulphide ion (S^2) is produced. Thus the ionic product of Ni^{2+} and S^{2-} ions is less than the K_{sp} ofNiS, so NiS will not precipitate out.

Question83

A white sodium salt dissolves readily in water to give a solution which is neutral to litmus. When silver nitrate solution is added to the aforementioned solution, a white precipitate is obtained which does not dissolve in dil. nitric acid. The anion is : [Online April 15, 2018 (I)]

Options:

A. CO_3^{2-}

B. SO_4^{2-}

C. S^2

D. Cl

Answer: D

Solution:

$$Cl^- + Na^+ \longrightarrow \underset{\text{Neutral}}{NaCl} \xrightarrow{AgNO_3} \underset{\text{(insoluble in dilute } HNO_3)}{AgCl\ (\text{white ppt})}$$

Question84

The correct match between items of List-I and List-II is :

List-I	List-II
A. Coloured impurity	(p) Steam distillation
B. Mixture of o -nitrophenoland p -nitrophenol	(q) Fractional distillation
C. Crude naphtha	(r) Charcoal treatment
D. Mixture of glycerol and sugars	(s) Distillation underreduced pressure

[Online April 15,2018(I)]

Options:

A. (A) − (r), (B) − (s), (C) − (p), (D) − (q)

B. (A) − (p), (B) − (s), (C) − (r), (D) − (q)

C. (A) − (r), (B) − (p), (C) − (q), (D) − (s)

D. (A) − (r), (B) − (p), (C) − (s), (D) − (q)

Answer: C

Solution:

(A) Charcoal treatment removes coloured impurity through adsorption.
(B) Steam distillation separates the mixture of o nitrophenol and p -nitrophenol. The o -nitrophenol is steam volatile (due to intramolecular hydrogen bonding), and the para isomer is not volatile.
(C) Fractional distillation separates crude naphtha. Naphtha is a flammable liquid hydrocarbon mixture.
(D) Distillation under reduced pressure separates mixture of glycerol and sugars. Vacuum distillation lowers the boiling point and prevents decomposition.

Question85

A solution containing a group-IV cation gives a precipitate on passing H_2S. A solution of this precipitate in dil.HCl produces a white precipitate with NaOH solution and bluish-white precipitate with basic potassium ferrocyanide. The cation is:
[Online April 8,2017]

Options:

A. Co^{2+}

B. Ni^{2+}

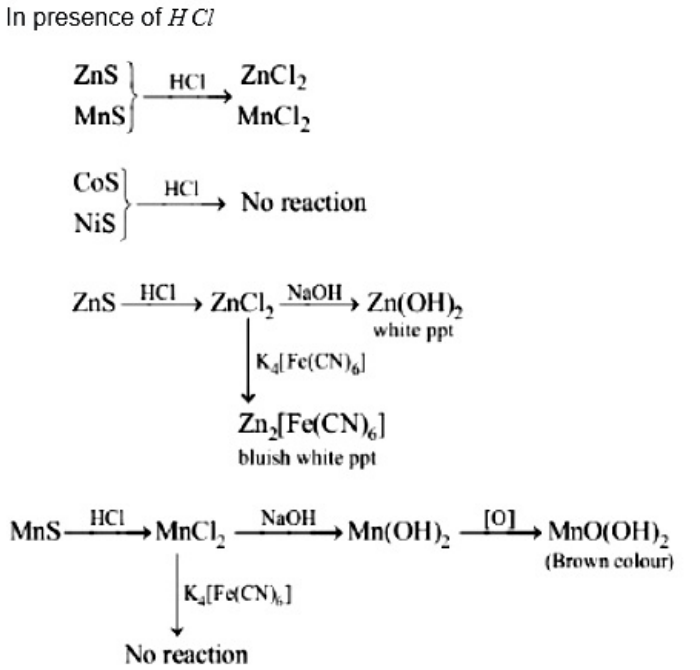
C. Mn^{2+}

D. Zn^{2+}

Answer: D

Solution:

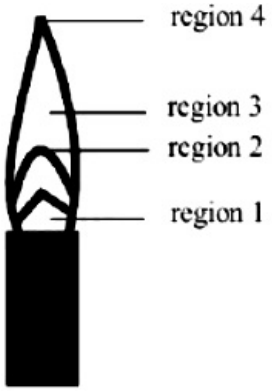
In presence of HCl



The above reaction path is confirming the presence of Zn^{2-} ion.

Question86

The hottest region of Bunsen flame shown in the figure below is:



[2016]

Options:

A. region 3

B. region 4

C. region 1

D. region 2

Answer: D

Solution:

Region 2 (blue flame) will be the hottest region of Bunsen flame as shown in given figure.

Question87

An aqueous solution of a salt X turns blood red on treatment with CNS^- and blue on treatment with $K_4[Fe(CN)_6]$. X also gives a positive chromyl chloride test. The salt X is:
[Online April 10, 2015]

Options:

A. $CuCl_2$

B. $FeCl_3$

C. $Cu(NO_3)_2$

D. $Fe(NO_3)_3$

Answer: B

Solution:

Fe^{3+}, radical gives blood red with SCN^-
$Fe^{3+} + 3CNS \rightarrow Fe(CNS)_3$ Ferric sulphocyanide (Blood red colouration)
Fe^{3+} gives blue colour on treatment with $K_4[Fe(CN)_6]$
$4Fe^{3+} + 3K_4[Fe(CN)_6] \rightarrow 12K^+ +$ $\underset{\text{Ferricferrocyanide(Prussian blue)}}{Fe_4[Fe(CN)_6]_3}$
Cl radical gives chromyl chloride test.

Question88

The cation that will not be precipitated by H_2S in the presence of dil. HCl is:
[Online April 10,2015]

Options:

A. Pb^{2+}

B. Cu^{2+}

C. Co^{2+}

D. As^{3+}

Answer: C

Solution:

(c) Co^{2+} ion is precipitated by H_2S in presence of NH_4OH which is a group reagent of group IV in cationic analysis.

Question89

A pink coloured salt turns blue on heating. The presence of which cation is most likely?
[Online April 11, 2015]

Options:

A. Co^{2+}

B. Cu^{2+}

C. Zn^{2+}

D. Fe^{2+}

Answer: A

Solution:

Solution:
Zn^{2+} salts are white. Usually Fe^{2+} salts are rarely pink. Cu^{2+} salts are usually blue in hydrated form. Co^{2+} is pink in aqueous solution.

Question90

Match the organic compounds in column-I with the Lassaigne's test results in column-II appropriately:

Column-I	Column-II
(A) Aniline	(i) Red colour with $FeCl_3$
(B) Benzene sulfonic acid	(ii) Violet colour with sodium nitroprusside
(C) Thiourea	(iii) Blue colour with hot and acidic solution of $FeSO_4$

[Online April 11,2015]

Options:

A. A − (ii); B − (iii); C − (i)

B. A − (iii); B − (i); C − (ii)

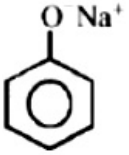
C. A − (iii); B − (ii); C − (i)

D. A − (ii); B − (i); C − (iii)

Answer: B

Solution:

In Lassaigne's test, fusion with sodium take place and following species formed respectively.
(a) Aniline $\longrightarrow CN^-$
(b) Benzene sulfonic acid $\longrightarrow$



(c) Thiourea $\longrightarrow S^{2-}$
Reaction of CN^- with hot and acidic solution of $FeSO_4$ lead to formation of $Fe_4[Fe(CN)_6]_3$ which is blue in colour. It contains iron in both II and III oxidation state. Reaction of S^{2-} with sodium nitroprusside
$Na_2S + Na_2[Fe(CN)_5NO] \rightarrow \underset{\text{(violet in colour)}}{Na_4[Fe(CN)_5NOS]}$
Phenoxide ion on reacting with $FeCl_3$ give red colour with $FeCl_3$

Question91

For the estimation of nitrogen, 1.4g of an organic compound was digested by Kjeldahl method and the evolved ammonia was absorbed in 60mL of $\frac{M}{10}$ sulphuric acid. The unreacted acid required 20mL of $\frac{M}{10}$ sodium hydroxide for complete neutralization. The percentage of nitrogen in the compound is:
[Online April 10,2015,2014]

Options:

A. 6%

B. 10%

C. 3%

D. 5%

Answer: B

Solution:

Element	%	Relative no. of atoms	Simplest ratio of atoms
C	20	20/12 = 1.66	1.0
H	6.67	6.67/1 = 6.67	4.16
N	46.67	46.67/14 = 3.33	2.02
O	26.64	26.64/16 − 1.66	1.0

∴ The empirical formulae is CH_4N_2O
Empirical weight = 60; Mol. wt. = 60;

$\therefore\ n = \frac{60}{60} = 1$
Molecular formula $= CH_4N_2O$
$NH_2 - CO - NH_2$ (Urea)
On heating, urea loses ammonia to give biuret.
$2NH_2CONH_2 \longrightarrow H_2NCO \cdot NH \cdot CONH_2 + NH_3$
Biuret with alkaline $CuSO_4$ gives violet colour.
Test for $-CONH-$ group.

Question92

Sodium Carbonate cannot be used in place of $(NH_4)_2CO_3$ for the identification of Ca^{2+}, Ba^{2+} and Sr^{2+} ions (in group V) during mixture analysis because : [Online April 9,2013]

Options:

A. Mg^{2+} ions will also be precipitated.

B. Concentration of CO_3^{2-} ions is very low.

C. Sodium ions will react with acid radicals.

D. Na^+ ions will interfere with the detection of Ca^{2+}, Ba^{2+}, Sr^{2+} ions.

Answer: A

Solution:

If Na_2CO_3 is used in place of $(NH_4)_2CO_3$. It will precipitate group V radicals as well as magnesium radicals. The reason for this is the high ionization of Na_2CO_3 in water into Na^+ and CO_3^{2-}. Now the higher concentration of CO_3^{2-} is available which exceeds the solubility product of group V radicals as well as that of magnesium radicals.

Question93

Which of the following statements is incorrect? [Online April 22, 2013]

Options:

A. Fe^{2+} ion also gives blood red colour with SCN^- ion.

B. Fe^{3+} ion also gives blood red colour with SCN^- ion.

C. On passing H_2S into Na_2ZnO_2 solution a white ppt of ZnS is formed.

D. Cupric ion reacts with excess of ammonia solution to give deep blue colour of $[Cu(NH_3)_4]^{2+}$ ion.

Answer: A

Solution:

Only Fe^{3+} ions give blood red colouration with SCN^- ions.
$Fe^{3+} + SCN^- \longrightarrow \underset{(dark\,red)}{[Fe(SCN)]^{2+}}$

Question94

Copper wire test for halogens is known as
[Online May 7, 2012]

Options:

A. Duma's Test

B. Beilstein's Test

C. Liebig's Test

D. Lassigne's Test

Answer: B

Solution:

Solution:
Beilstein's test : Organic compounds containing halogens when heated over Cu wire loop give blue or green colour flame due to formation of volatile copper halides.

Question95

Beilstein test is used for the estimation of which one of the following elements?
[Online May 19,2012]

Options:

A. S

B. Cl

C. C and H

D. N

Answer: B

Solution:

Beilstein's test is used for halogens.

Question96

29.5mg of an organic compound containing nitrogen was digested according to Kjeldahl's method and the evolved ammonia was absorbed in 20mL of 0.1M HCl solution. The excess of the acid required 15mL of 0.1M $NaOH$ solution for complete neutralization. The percentage of nitrogen in the compound is
[2010]

Options:

A. 59.0

B. 47.4

C. 23.7

D. 29.5

Answer: C

Solution:

Moles of HCl taken $= 20 \times 0.1 \times 10^{-3}$
$= 2 \times 10^{-3}$
Moles of HCl neutralised by $NaOH$ solution
$= 15 \times 0.1 \times 10^{-3} = 1.5 \times 10^{-3}$ Moles of HCl neutralised by ammonia $= 2 \times 10^{-3} - 1.5 \times 10^{-3}$
-0.5×10^{-3}
Moles of NH_3 absorbed $= 0.5 \times 10^{-3}$
Moles of N in $NH_3 = 0.5 \times 10^{-3}$
Mass of N in organic compound $= 14 \times 0.5 \times 10^{-3}$g
%N in organic compound $= \frac{14 \times 0.5 \times 10^{-3}}{29.5 \times 10^{-3}} \times 100$
$= 23.7\%$

Question97

An organic compound having molecular mass 60 is found to contain C = 20%, H = 6.67% and N = 46.67% while rest is oxygen. On heating it gives NH_3 alongwith a solid residue. The solid residue give violet colour with alkaline copper sulphate solution. The compound is
[2005]

Options:

A. $CH_3CH_2CONH_2$

B. $(NH_2)_2CO$

C. CH_3CONH_2

D. CH_3NCO

Answer: B

Solution:

Element	%	Relative no. of atoms	Simplest ratio of atoms
C	20	20/12 = 1.66	1
H	6.67	6.67/1 = 6.67	4.16
N	46.67	46.67/14 = 3.33	2.02
O	26.64	26.64/16 − 1.66	1.0

∴ The empirical formula is CH_4N_2O

Empirical weight = 60; Mol. wt. = 60; $\therefore n = \frac{60}{60} = 1$

Molecular formula = CH_4N_2O; $NH_2-\overset{O}{\overset{\|}{C}}-NH_2$ (urea)

On heating, urea loses ammonia to give biuret.

$2NH_2CONH_2 \longrightarrow H_2NCO \cdot NH \cdot CONH_2 + NH_3$

Biuret with alkaline $CuSO_4$ gives violet colour. Test for CONH-group.

Question98

The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is [2004]

Options:

A. $Fe_4[Fe(CN)_6]_3$

B. $Na_3[Fe(CN)_6]$

C. $Fe(CN)_3$

D. $Na_4[Fe(CN)_5NOS]$

Answer: A

Solution:

Prussian blue $Fe_4[Fe(CN)_6]_3$ is formed in Lassaigne test for nitrogen.

$$Na + \underset{\text{(From org. comp.)}}{C + N} \xrightarrow{\text{Fuse}} NaCN$$

$$FeSO_4 + 2NaOH \longrightarrow \underset{\text{Green ppt.}}{Fe(OH)_2\downarrow} + Na_2SO_4$$

$$Fe(OH)_2 + 2NaCN \longrightarrow Fe(CN)_2 + 2NaOH$$

$$Fe(CN)_2 + 4NaCN \longrightarrow \underset{\text{Sod. ferrocyanide}}{Na_4[Fe(CN)_6]}$$

$3Na_4[Fe(CN)_6] + 4FeCl_3 \longrightarrow \underset{\text{Ferricferrocyanide(Prussian blue)}}{Fe_4[Fe(CN)_6]_3} + 12NaCl$

Question99

Which one of the following statements is correct? [2003]

Options:

A. From a mixed precipitate of AgCl and AgI, ammonia solution dissolves only AgCl

B. Ferric ions give a deep green precipitate on adding potassium ferrocyanide solution

C. On boiling a solution having K^+, Ca^{2+} and HCO_3^- ions we get a precipitate of $K_2Ca(CO_3)_2$

D. Manganese salts give a violet borax bead test in the reducing flame

Answer: A

Solution:

Between AgCl and AgI , AgI is less soluble, hence ammonia can dissolve ppt. of AgCl only due to formation of complex as given below:
$AgCl + 2NH_3 \longrightarrow [Ag(NH_3)_2]Cl$

Question100

When H_2S is passed through Hg_2S we get [2002]

Options:

A. HgS

B. $HgS + Hg_2S$

C. $Hg_2S + Hg$

D. None of these.

Answer: C

Solution:

When H_2S is passed through Hg_2S we get a mixture of mercurous sulphide and mercury ($Hg_2S + Hg$).

Question101

How do we differentiate between Fe^{3+} and Cr^{3+} in group III? [2002]

Options:

A. by taking excess of NH_4OH solution

B. by increasing NH_4^+ ion concentration

C. by decreasing OH^- ion concentration

D. both (b) and (c)

Answer: B

Solution:

When we add NH_4Cl, it suppresses the ionisation of NH_4OH and prevents the precipitation of higher group hydroxide in gp(III). Note: Further ferric chloride and chromium chloride form different colour precipitates with NH_4OH.

$FeCl_3 + 3NH_4OH \longrightarrow Fe(OH)_3 \downarrow + 3NH_4Cl$

$CrCl_3 + 3NH_4OH \longrightarrow \underset{\text{Bluish green}}{Cr(OH)_3} + 3NH_4Cl$
