CHEMISTRY

SECTION-A

1. The water having more dissolved O_2 is :

(1) boiling water

(2) water at 80°C

(3) polluted water

(4) water at 4°C

Official Ans. by NTA (4)

Sol. On heating concentration of O_2 in water decreases. So boiling water and water at 80°C having less O_2 concentration. Polluted water also having less O_2 concentration. So water at 4°C having maximum O_2 concentration.

2. Which one of the following statements for D.I. Mendeleeff, is **incorrect**?

(1) He authored the textbook – Principles of Chemistry.

(2) At the time, he proposed Periodic Table of elements structure of atom was known.

(3) Element with atomic number 101 is named after him.

(4) He invented accurate barometer.

Official Ans. by NTA (2)

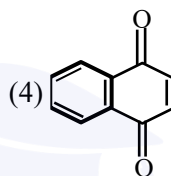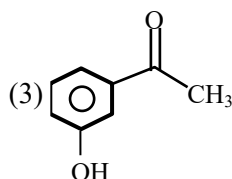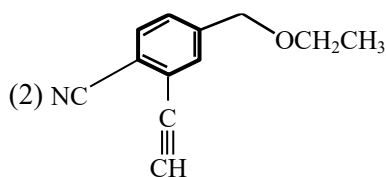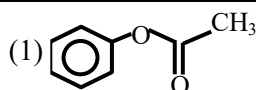**Sol.** At the time, he proposed the periodic table but structure of atom was unknown.

3. Which purification technique is used for high boiling organic liquid compound (decomposes near its boiling point)?

(1) Simple distillation

(2) Steam distillation

(3) Fractional distillation

(4) Reduced pressure distillation
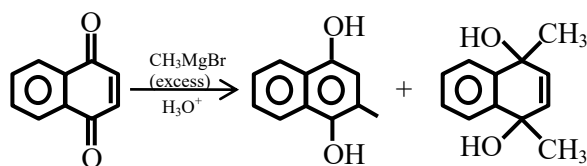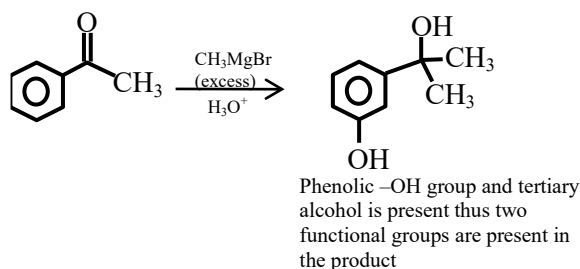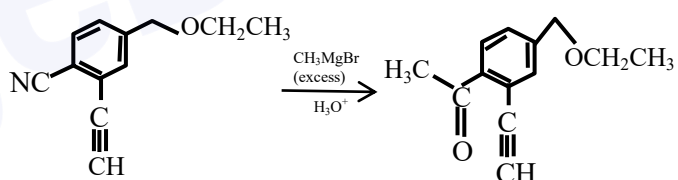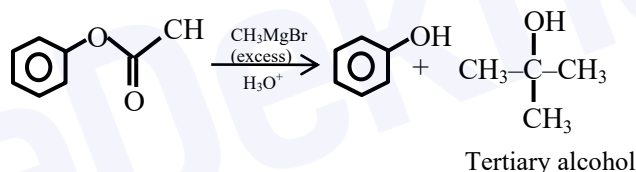
Official Ans. by NTA (4)

Sol. Reduced pressure distillation or vacuum distillation is used for the purification of high boiling organic liquids which decomposes at or below their boiling point.

4. Which of the following compounds will provide a tertiary alcohol on reaction with excess of CH_3MgBr followed by hydrolysis?
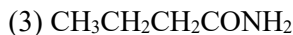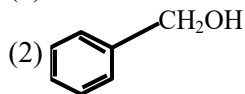

(1)

(2)

(3)

(4)

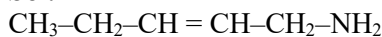**Official Ans. by NTA (1)**

Sol.

Tertiary alcohol

Phenolic –OH group and tertiary alcohol is present thus two functional groups are present in the product

5. Which of the following compounds does not exhibit resonance?

(1) $CH_3CH_2OCH=CH_2$

(2)

(3) $CH_3CH_2CH_2CONH_2$

(4) $CH_3CH_2CH=CHCH_2NH_2$

Official Ans. by NTA (4)

Sol.

$CH_3–CH_2–CH = CH–CH_2–NH_2$

No conjugation thus resonance is not possible.

6. Match **List-I** with **List-II**

List-I (Elements)	List-II (Properties)
(a) Ba	(i) Organic solvent soluble compounds
(b) Ca	(ii) Outer electronic configuration $6s^2$
(c) Li	(iii) Oxalate insoluble in water
(d) Na	(iv) Formation of very strong monoacidic base

Choose the **correct** answer from the options given below :

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

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

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

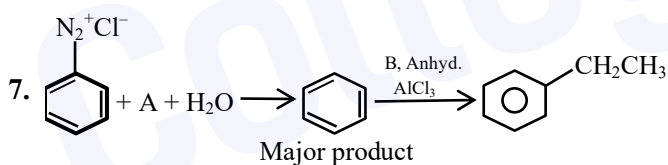(4) (a)-(i), (b)-(iv), (c)-(ii) and (d)-(iii)

Official Ans. by NTA (1)

Sol. (a) 'Ba' having outer electronic configuration $6s^2$.

(b) CaC_2O_4 is water insoluble

(c) 'Li' is soluble in organic solvents

(d) NaOH is strong Monoacidic base among given.

7.

In the chemical reactions given above A and B respectively are :
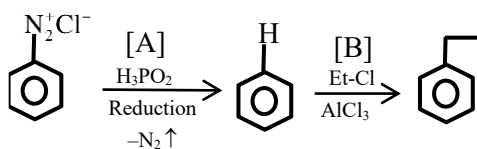
(1) H_3PO_2 and CH_3CH_2Cl

(2) CH_3CH_2OH and H_3PO_2

(3) H_3PO_2 and CH_3CH_2OH

(4) CH_3CH_2Cl and H_3PO_2

Official Ans. by NTA (1)

Sol.

8. Isotope(s) of hydrogen which emits low energy β^- particles with $t_{1/2}$ value > 12 years is/are

(1) Protium

(2) Tritium

(3) Deuterium

(4) Deuterium and Tritium

Official Ans. by NTA (2)

Sol. $_1^1H$ and $_1^2H$ are stable while $_1^3H$ is radioactive.

9. Match **List-I** with **List-II** :

List-I (Species)	List-II (Hybrid Orbitals)
(a) SF_4	(i) sp^3d^2
(b) IF_5	(ii) d^2sp^3
(c) NO_2^+	(iii) sp^3d
(d) NH_4^+	(iv) sp^3
	(v) sp

Choose the **correct** answer from the options given below :

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

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

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

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

Official Ans. by NTA (3)

Sol. (a) SF_4 – sp^3d hybridisation

(b) IF_5 – sp^3d^2 hybridisation

(c) NO_2^+ – sp hybridisation

(d) NH_4^+ – sp^3 hybridisation

10. When silver nitrate solution is added to potassium iodide solution then the sol produced is :

(1) AgI / I^- (2) AgI / Ag^+

(3) KI / NO_3^- (4) $AgNO_3 / NO_3^-$

Official Ans. by NTA (1)

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

11. Which of the following molecules does not show stereo isomerism ?

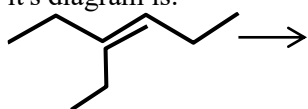(1) 3,4-Dimethylhex-3-ene

(2) 3-Methylhex-1-ene

(3) 3-Ethylhex-3-ene

(4) 4-Methylhex-1-ene

Official Ans. by NTA (3)

Sol. 3-Ethylhex-3-ene will not show stereo isomerism it's diagram is.

 → (1) Not show geometrical isomerism

(2) Not show optical isomerism

12. Given below are the statements about diborane
(a) Diborane is prepared by the oxidation of $NaBH_4$ with I_2
(b) Each boron atom is in sp^2 hybridized state
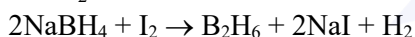(c) Diborane has one bridged 3 centre-2-electron bond
(d) Diborane is a planar molecule
The option with **correct** statement(s) is -
(1) (c) and (d) only
(2) (a) only
(3) (c) only
(4) (a) and (b) only
Official Ans. by NTA (2)

Sol.

Diborane is prepared by the reaction of $NaBH_4$ with I_2.
$2NaBH_4 + I_2 \rightarrow B_2H_6 + 2NaI + H_2$
In diborane, 'B' is sp^3 hybrid, it is Non-planar and two $3c$–$2e^-$ bonds are present.

13. Which one of the following group-15 hydride is the strongest reducing agent ?
(1) AsH_3 (2) BiH_3 (3) PH_3 (4) SbH_3
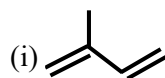**Official Ans. by NTA (2)**

Sol.

Among 15th group hydrides, BiH_3 is strongest reducing agent.

14. Match **List-I** with **List-II :**
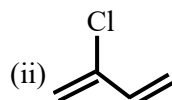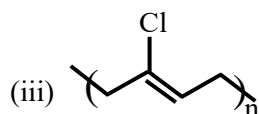
List-I   List-II

(a) Chloroprene   (i)

(b) Neoprene   (ii)

(c) Acrylonitrile   (iii)

(d) Isoprene   (iv) $CH_2=CH–CN$
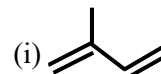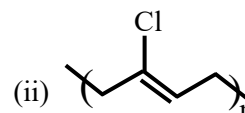
Choose the **correct** answer from the options given below:
(1) (a) - (iii), (b)-(iv), (c) -(ii), (d) -(i)
(2) (a) - (ii), (b)-(iii), (c) -(iv), (d) -(i)
(3) (a) - (ii), (b)-(i), (c) -(iv), (d) -(iii)
(4) (a) - (iii), (b)-(i), (c) -(iv), (d) -(ii)
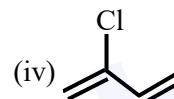**Official Ans. by NTA (2)**

Sol. (a) Chloroprene   (i)

(b) Neoprene   (ii)

(c) Acrylonitrile   (iii) $CH_2=CH–CN$

(d) Isoprene   (iv)

15. The set having ions which are coloured and paramagnetic both is -
(1) Cu^{2+}, Cr^{3+}, Sc^+
(2) Cu^{2+}, Zn^{2+}, Mn^{4+}
(3) Sc^{3+}, V^{5+}, Ti^{4+}
(4) Ni^{2+}, Mn^{7+}, Hg^{2+}
Official Ans. by NTA (1)

Sol.

$Cu^{2+} : [Ar]3d^9 4s^0$ ⎤ All are coloured and
$Cr^{3+} : [Ar]3d^3 4s^0$ ⎬ paramagnetic due to
$Sc^+ : [Ar]3d^1 4s^1$ ⎦ presence of unpaired electrons

16. Thiamine and pyridoxine are also known respectively as :
(1) Vitamin B_2 and Vitamin E
(2) Vitamin E and Vitamin B_2
(3) Vitamin B_6 and Vitamin B_2
(4) Vitamin B_1 and Vitamin B_6
Official Ans. by NTA (4)

Sol. Vitamine-B_1 is also known as Thiamine while vitamin B-6 is known as Pyridoxine

17. Sulphide ion is soft base and its ores are common for metals.
(a) Pb   (b) Al
(c) Ag   (d) Mg

Choose the **correct** answer from the options given below :

(1) (a) and (c) only
(2) (a) and (d) only
(3) (a) and (b) only
(4) (c) and (d) only

Official Ans. by NTA (1)

Sol. Pb and Ag commonly exist in the form of sulphide ore like PbS (galena) and Ag_2S (Argentite)

'Al' is mainly found in the form of oxide ore whereas 'Mg' is found in the form of halide ore.

18. An organic compound A (C_6H_6O) gives dark green colouration with ferric chloride. On treatment with $CHCl_3$ and KOH, followed by acidification gives compound B. Compound B can also be obtained from compound C on reaction with pyridinium chlorochromate (PCC). Identify A, B and C.
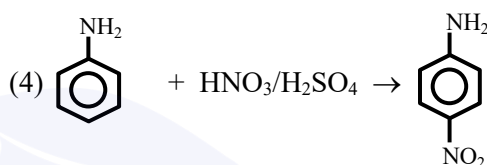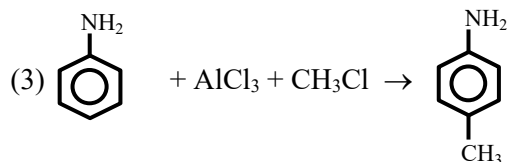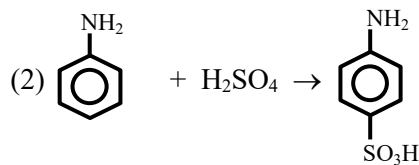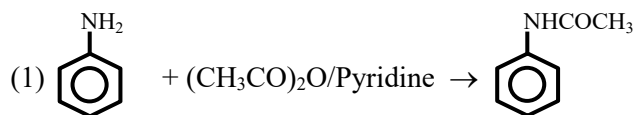
(1)

(2)

(3)

(4)
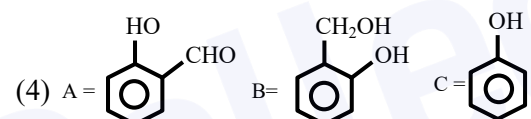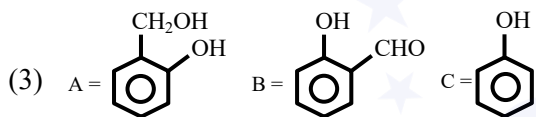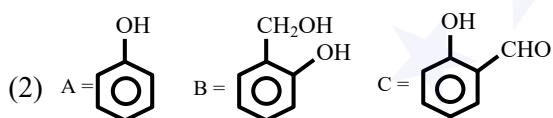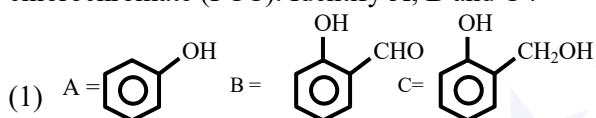
Official Ans. by NTA (1)

Sol.
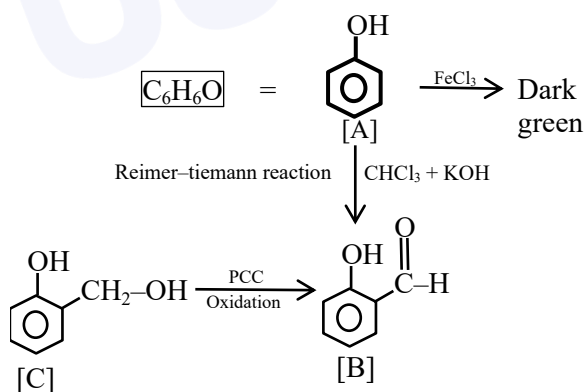
19. Which one of the following reactions does not occur?

(1)

(2)

(3)

(4)

Official Ans. by NTA (3)

Sol.
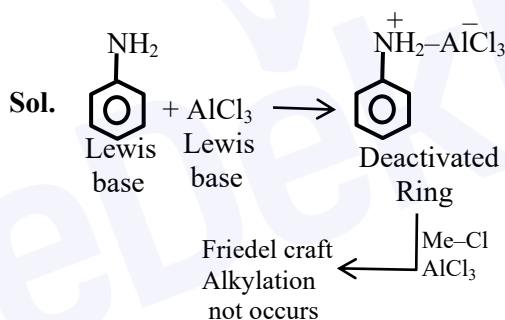
(1) Aniline is lewis base give acid base reaction with $AlCl_3$ and form Anilinium ion

(2) Anilinium ion has strongest deactivated ring so further Friedel craft Alkylation not occurs.

20. Which one of the following 0.06 M aqueous solutions has lowest freezing point ?

(1) $Al_2(SO_4)_3$ (2) $C_6H_{12}O_6$
(3) KI   (4) K_2SO_4

Official Ans. by NTA (1)

Sol. $T_f - T_f' = i\,K_f.m$

For minimum T_f'

'i' should be maximum.

$Al_2(SO_4)_3$ i = 5
$C_6H_{12}O_6$ i = 1
KI   i = 2
K_2SO_4 i = 3

SECTION-B

1. The total number of unpaired electrons present in $[Co(NH_3)_6]Cl_2$ and $[Co(NH_3)_6]Cl_3$ is

Official Ans. by NTA (1)
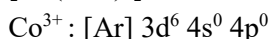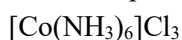
Sol.

$[Co(NH_3)_6]Cl_2$

Co^{2+} : $[Ar]3d^7 4s^0 4p^0$
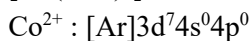
For this complex $\Delta_0 <$ P.E., so pairing of electron does not take place.

sp^3d^2 hybridisation

Total 3 unpaired electrons are present.

$[Co(NH_3)_6]Cl_3$

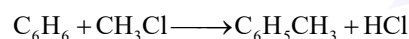Co^{3+} : $[Ar]\ 3d^6\ 4s^0\ 4p^0$

$\qquad d^2sp^3$ hybridisation

NH_3 acts as SFL because $\Delta_0 >$ P.E.

So here all electrons becomes paired.

2. Methylation of 10 g of benzene gave 9.2 g of toluene. Calculate the percentage yield of toluene _____. (Nearest integer)
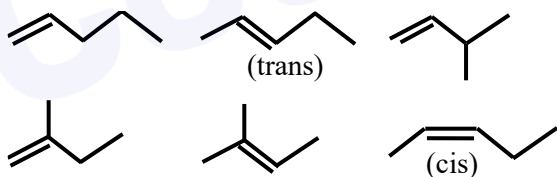
Official Ans. by NTA (78)

Sol.

$$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$$

$$\frac{10}{78} \qquad\qquad \left(\frac{10}{78} \times 92\right) gm \Rightarrow$$

$$\frac{A_y}{T_y} = \%\text{yield} = \frac{9.2}{920} \times 78 \times 100 \Rightarrow 78\%$$

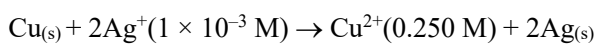**3.** The number of acyclic structural isomers (including geometrical isomers) for pentene are ____

Official Ans. by NTA (6)

Sol.

4. Assume a cell with the following reaction

$$Cu_{(s)} + 2Ag^+(1 \times 10^{-3}\ M) \to Cu^{2+}(0.250\ M) + 2Ag_{(s)}$$

$$E^1_{cell} = 2.97\,V$$

E_{cell} for the above reaction is _____V. (Nearest integer)

[Given : log 2.5 = 0.3979, T = 298 K]

Official Ans. by NTA (3)

Sol.

$$E = E° - \frac{0.059}{2}\log\frac{[Cu^{+2}]}{[Ag^+]^2}$$

$$= 2.97 - \frac{0.059}{2}\log\frac{0.25}{(10^{-3})^2} = 2.81V$$

5. Value of K_P for the equilibrium reaction
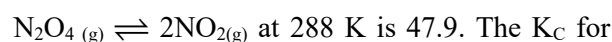
$N_2O_{4\ (g)} \rightleftharpoons 2NO_{2(g)}$ at 288 K is 47.9. The K_C for this reaction at same temperature is _____. (Nearest integer)

$(R = 0.083$ L bar K^{-1} mol$^{-1})$

Official Ans. by NTA (2)

Sol. $K_C = \dfrac{K_P}{RT} = \dfrac{47.9}{0.083 \times 288} = 2$

6. If the standard molar enthalpy change for combustion of graphite powder is -2.48×10^2 kJ mol^{-1}, the amount of heat generated on combustion of 1 g of graphite powder is _____ kJ. (Nearest integer)

Official Ans. by NTA (21)

Sol. 1 mol graphite = 12 gm C

Ans. $= \dfrac{248}{12} = 20.67 kJ/gm$ heat evolved

7. A copper complex crystallising in a CCP lattice with a cell edge of 0.4518 nm has been revealed by employing X-ray diffraction studies. The density of a copper complex is found to be 7.62 g cm^{-3}. The molar mass of copper complex is _____ g mol^{-1}. (Nearest integer)

[Given : $N_A = 6.022 \times 10^{23}$ mol^{-1}]

Official Ans. by NTA (106)

Sol. $d\left(\dfrac{gm}{cc}\right) = \dfrac{4 \times \dfrac{M}{N_A}}{(a\ cm)^3}$
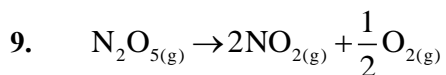
$$7.62 = \frac{4 \times M/6.022 \times 10^{23}}{(0.4518 \times 10^{-7} cm)^3} \Rightarrow M = 105.8\ g/mol$$

8. Number of electrons that Vanadium (Z = 23) has in p-orbitals is equal to _____

Official Ans. by NTA (12)

Sol. $_{23}V$: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$

Number of electrons in p-orbitals is equal to 12.00

9. $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \dfrac{1}{2}O_{2(g)}$

In the above first order reaction the initial concentration of N_2O_5 is 2.40×10^{-2} mol L^{-1} at 318 K. The concentration of N_2O_5 after 1 hour was 1.60×10^{-2} mol L^{-1}. The rate constant of the reaction at 318 K is _____ $\times 10^{-3}$ min^{-1}. (Nearest integer)

[Given : log 3 = 0.477, log 5 = 0.699]

Official Ans. by NTA (7)

Sol. $K = \dfrac{2.303}{t} \log \dfrac{[N_2O_5]_0}{[N_2O_5]_t}$

$= \dfrac{2.303}{60} \log \dfrac{2.4}{1.6} = 6.76 \times 10^{-3}$ min$^{-1} \approx 7 \times 10^{-3}$ min^{-1}

10. If the concentration of glucose ($C_6H_{12}O_6$) in blood is 0.72 g L^{-1}, the molarity of glucose in blood is _____ $\times 10^{-3}$M. (Nearest integer)

[Given : Atomic mass of C = 12, H = 1, O = 16 u]

Official Ans. by NTA (4)

Sol. $[Glucose] = \dfrac{C(gm/\ell)}{M(gm/mol)} = \dfrac{0.72}{180} = 4 \times 10^{-3} M$