

JEE Main July 2021
Question Paper With Text Solution
22 July. | Shift-2

CHEMISTRY



JEE Main & Advanced | XI-XII Foundation | VI-X Pre-Foundation

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JEE MAIN JULY 2021 | 22TH JULY SHIFT-2
SECTION - A

1. Match List -I with List- II:

List - I

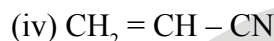
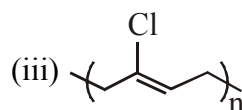
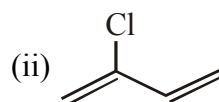
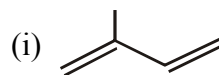
(a) Chloroprene

(b) Neoprene

(c) Acrylonitrile

(d) Isoprene

List - II



Chose the correct answer from the options given below:

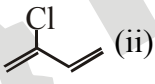
(1) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

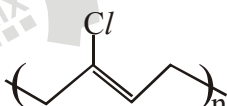
(2) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

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

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

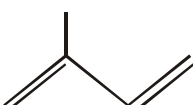
Ans. Official Answer NTA (2)

 Sol. (a) Chloroprene $\rightarrow$  (ii)

 (b) Neoprene $\rightarrow$  (iii)

(Neoprene is produced by free radical polymerisation of chloroprene)

 (c) Acrylonitrile $\rightarrow \text{H}_2\text{C} = \text{CH} - \text{CN}$ (iv)

 (d) Isoprene $\rightarrow$  (i)

correct answer : a - (ii), b - (iii), c - (iv), d - (i); option (2)

2. Which one of the following 0.06 M aqueous solution has lowest freezing point?

 (1) $\text{C}_6\text{H}_{12}\text{O}_6$

 (2) $\text{Al}_2(\text{SO}_4)_3$

(3) KI

 (4) K_2SO_4
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Ans. Official Answer NTA (2)

Sol. $\Delta T_f = i k_f m$

for freezing point to be lowest, ΔT_f should be highest and so, the i .

Solute	i
$C_6H_{12}O_6$	1
$Al_2(SO_4)_3$	5 $\rightarrow$ i highest, ΔT_f maximum, T_f minimum
KI	2
K_2SO_4	3

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

- (1) Fractional distillation
- (2) Reduced pressure distillation
- (3) Simple distillation
- (4) Steam distillation

Ans. Official Answer NTA (2)

Sol. Since the boiling points of liquids are decreased at reduced pressure, organic compounds can be distilled at lower temperatures. This is mainly used for those compounds whose boiling point is near to their decomposition temperature. By reducing pressure, it can be distilled at low boiling point to avoid their decomposition.

4. The water having more dissolved O_2 is:

- (1) water at $80^\circ C$
- (2) water at $4^\circ C$
- (3) Polluted water
- (4) boiling water

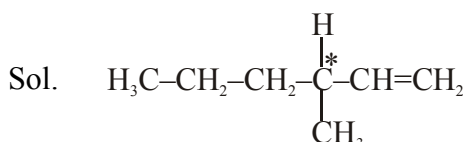
Ans. Official Answer NTA (2)

Sol. Since, dissolution of O_2 gas in water is an exothermic process, solubility of oxygen in water is high at lower temperature.

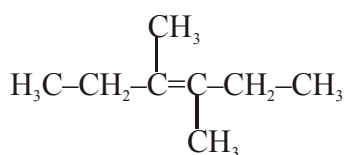
5. Which one of the following molecules does not show stereo isomerism?

- (1) 2-Methylhex-1-ene
- (2) 3,4-Dimethylhex-3-ene
- (3) 4-Methylhex-1-ene
- (4) 3-Ethylhex-3-ene

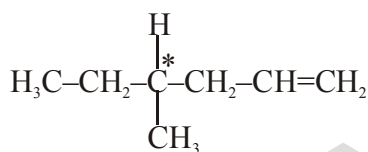
Ans. Official Answer NTA (4)



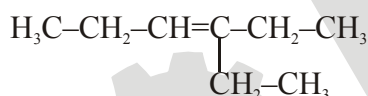
1 chiral carbon $\Rightarrow$ optically active



geometrical isomers.



1 chiral carbon $\Rightarrow$ optically active.



No geometrical Isomers, No optical activity

correct answer (4)

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

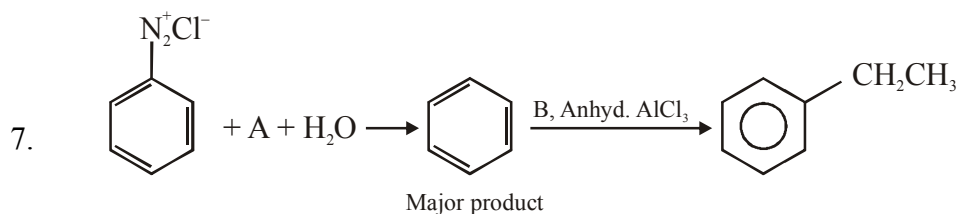
- (1) $\text{KI} / \text{NO}_3^-$
- (2) AgI / Ag^+
- (3) AgI / I^-
- (4) $\text{AgNO}_3 / \text{NO}_3^-$

Ans. Official Answer NTA (3)

Sol. Since AgNO_3 solution was passed to KI solution, the AgI / I^- sol. was produced.

(here, the KI solution through which AgNO_3 passed, was considered to be in excess)

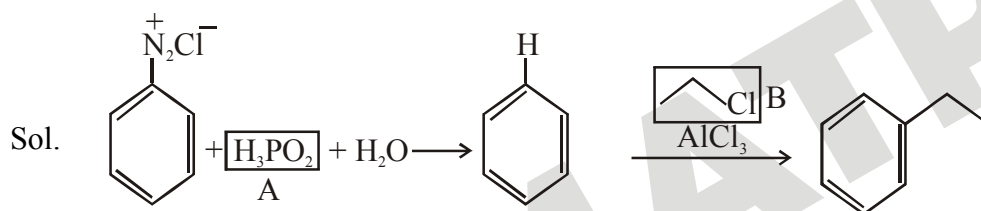
correct answer (3).



In the chemical reactions given above A and B respectively are:

- (1) H_3PO_2 and $\text{CH}_3\text{CH}_2\text{OH}$
- (2) H_3PO_2 and $\text{CH}_3\text{CH}_2\text{Cl}$
- (3) $\text{CH}_3\text{CH}_2\text{Cl}$ and H_3PO_2
- (4) $\text{CH}_3\text{CH}_2\text{OH}$ and H_3PO_2

Ans. Official Answer NTA (2)



Correct option ...(2)

8. Match Listg - I with List - II:

List - I

(Elements)

- (a) Ba
- (b) Ca
- (c) Li
- (d) Na

List - II

(Properties)

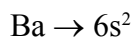
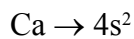
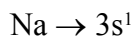
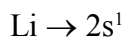
- (i) Organic solvent soluble compounds
- (ii) Outer electronic configuration $6s^2$
- (iii) Oxalate insoluble in water
- (iv) Formation of very strong monoacidic base

Choose the correct answer from the options given below:

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

Ans. Official Answer NTA (4)

Sol. Outer electronic configuration



(a) $\text{Ba} \rightarrow$ outer electronic configuration $\rightarrow 6s^2$ (ii)

(b) $\text{Ca} \rightarrow$ Calcium oxalate (CaC_2O_4) $\rightarrow$ insoluble in water (iii)

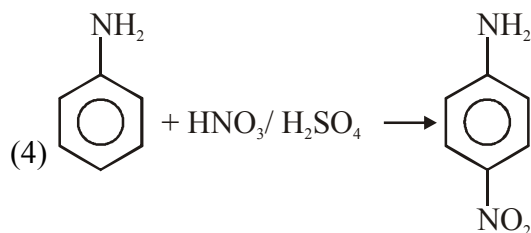
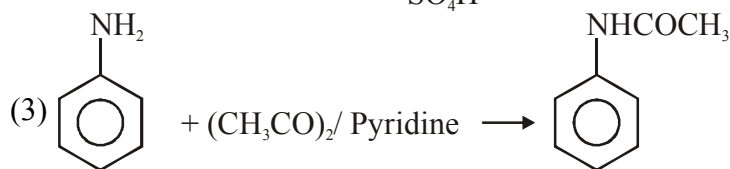
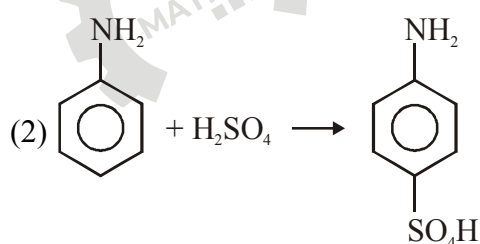
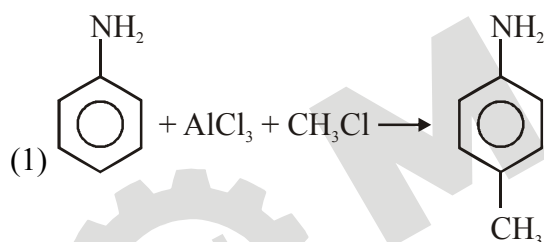
(c) $\text{Li} \rightarrow$ Being small in size, the compounds of lithium are covalent in nature, so its compounds are soluble in organic solvent.

eg : LiCl is soluble in pyridine. (i)

(d) $\text{Na} \rightarrow \text{NaOH}$, strong monoacidic base (iv)

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

9. Which one of the following reactions does not occur?

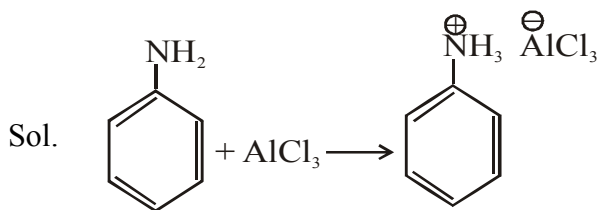


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Ans. Official Answer NTA (1)



Due to lone pair of electrons on N, aniline is a strong lewis base, So an acid base reaction occurs between aniline and AlCl_3 leading to anilinium salt formation.

Since, NH_3^+ is a deactivating group and hence electrophilic substitution via friedel craft alkylation doesn't take place.

10. 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

Ans. Official Answer NTA (4)

Sol. Thiamine is also called **vitamin B1**
and pyridoxine is also known as **vitamin B6**

11. Match List -I with List -II:

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

Choose the corect answer from the options given below:

- (1) (a) - (iii), (b) - (i), (c) -(v) and (d) - (iv)
- (2) (a) - (iv), (b) - (iii), (c) -(ii) and (d) - (v)
- (3) (a) - (ii), (b) - (i), (c) -(iv) and (d) - (v)
- (4) (a) - (i), (b) - (ii), (c) -(v) and (d) - (iii)

Ans. Official Answer NTA (1)

Sol. $\text{SF}_4 \Rightarrow \text{S} \rightarrow \text{sp}^3\text{d}$ hybridised(iii)

$\text{IF}_5 \Rightarrow \text{I} \rightarrow \text{sp}^3\text{d}^2$ hybridised(i)

$\text{NO}_2^+ \Rightarrow \text{N} \rightarrow \text{sp}$ hybridised(v)

$\text{NH}_4^+ \Rightarrow \text{N} \rightarrow \text{sp}^3$ hybridised(iv)

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

12. The set having ions which are coloured and paramagnetic both is :

(1) Ni^{2+} , Mn^{7+} , Hg^{2+}

(2) Cu^{2+} , Cr^{3+} , Sc^+

(3) Cu^+ , Zn^{2+} , Mn^{4+}

(4) Sc^{3+} , V^{5+} , Ti^{4+}

Ans. Official Answer NTA (2)

Sol. Unpaired electron

$\text{Cu}^{2+}(3\text{d}^9)$, $n = 1$

$\text{Cr}^{3+}(3\text{d}^3)$, $n = 3$

$\text{Sc}^+(3\text{d}^1 4\text{s}^1)$, $n = 2$

Due to having unpaired electron(s) Cu^{2+} , Cr^{3+} and Sc^+ are paramagnetic and coloured.

* $\text{Mn}^{7+}(\text{d}^0)$, $\text{Hg}^{2+}(\text{d}^{10})$, $\text{Zn}^{2+}(\text{d}^{10})$, $\text{Cu}^+(\text{d}^{10})$, $\text{Sc}^{3+}(\text{d}^0)$, $\text{Ti}^{4+}(\text{d}^0)$ are diamagnetic in nature.

13. 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) only

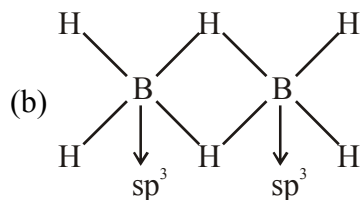
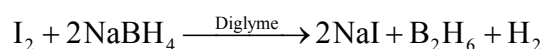
(3) and (b) only

(4) only

Ans. Official Answer NTA (2)

Sol. Diborane (B_2H_6)

(a) The oxidation of sodium borohydride with iodine in diglyme gives diborane.



2 bridged $3c - 2e^-$ bond.

Non-planar Molecule.

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

- (1) He invented accurate barometer.
- (2) He authored the textbook - principles of chemistry.
- (3) At the time, he proposed periodic Table of elements structure of atom was known.
- (4) Element with atomic number 101 is named after him.

Ans. Official Answer NTA (3)

Sol. At the time, he proposed periodic Table of elements structure of atom was not known.

15. 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 (b) only
- (3) (a) and (d) only
- (4) (c) and (d) only

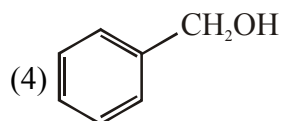
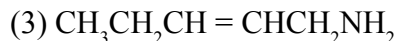
Ans. Official Answer NTA (1)

Sol. Pb and Ag are found as sulphide ORE.

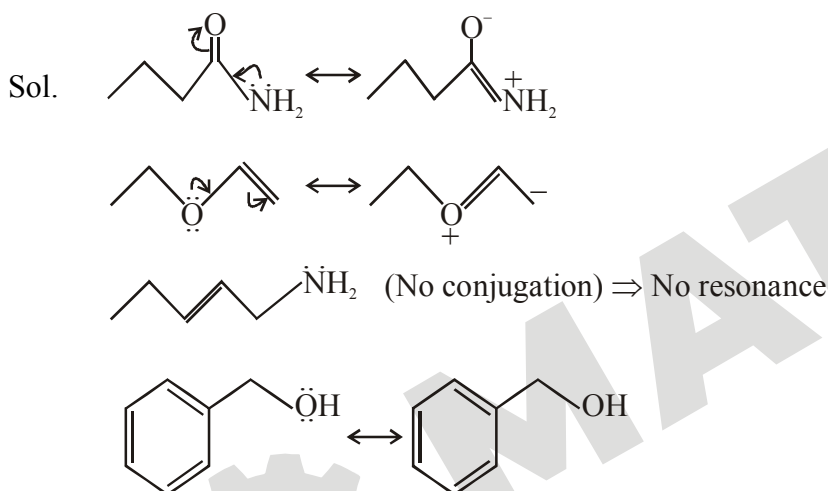
PbS (Galena)

Ag₂S (Silver glance)

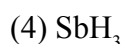
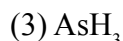
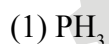
16. Which one of the following compounds does not exhibit resonance?



Ans. Official Answer NTA (3)



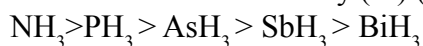
17. Which one of the following group-15 hydride is the strongest reducing agent?



Ans. Official Answer NTA (2)

Sol. Reducing nature of hydride $\propto \frac{1}{\text{Thermal stability (or) Bond Strength}}$

* order of thermal stability (or) (C.A. - H) bond strength :

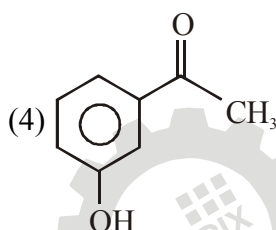
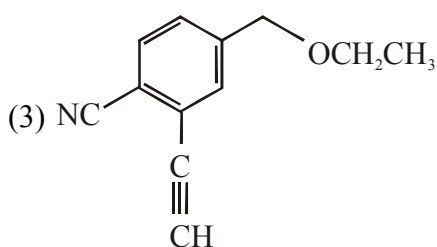
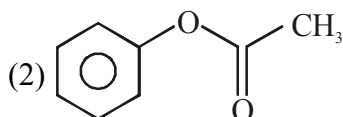
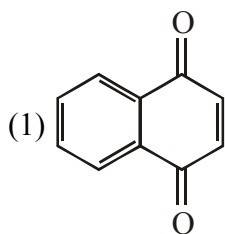


* order of reducing nature

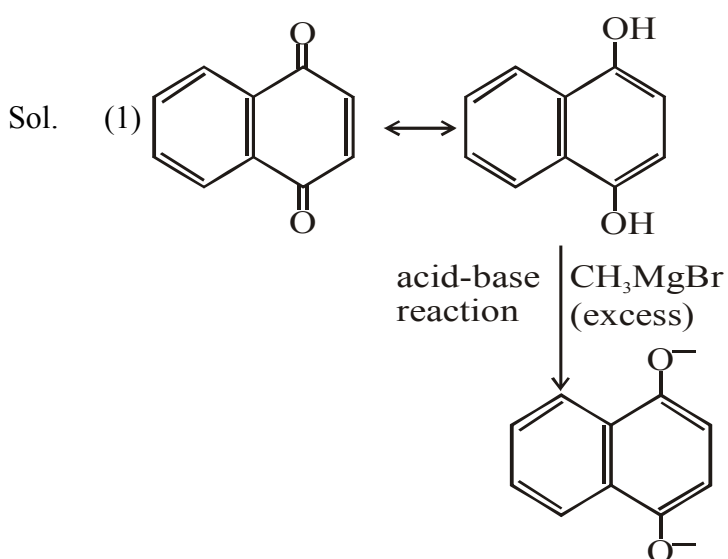




18. Which one of the following compounds will provide a tertiary alcohol on reaction with excess of CH_3MgBr followed by hydrolysis?



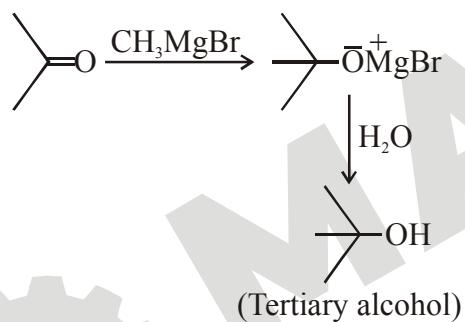
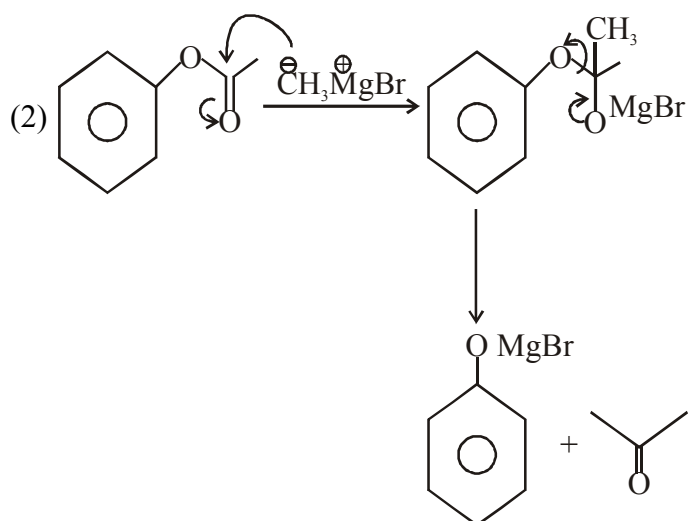
Ans. Official Answer NTA (2)

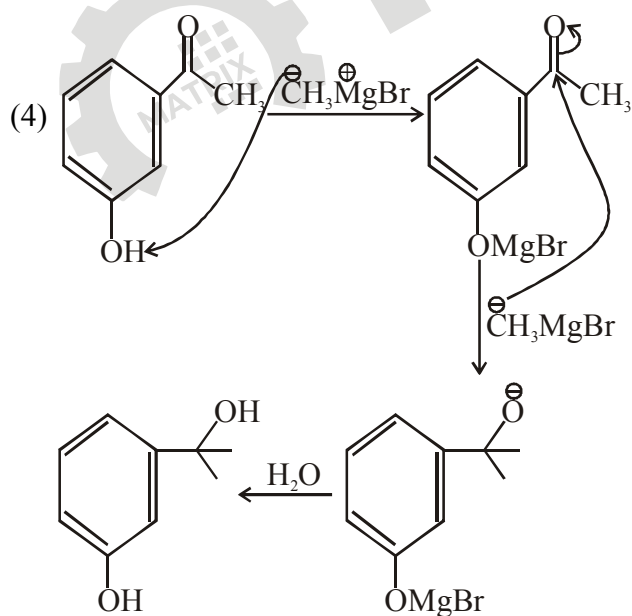
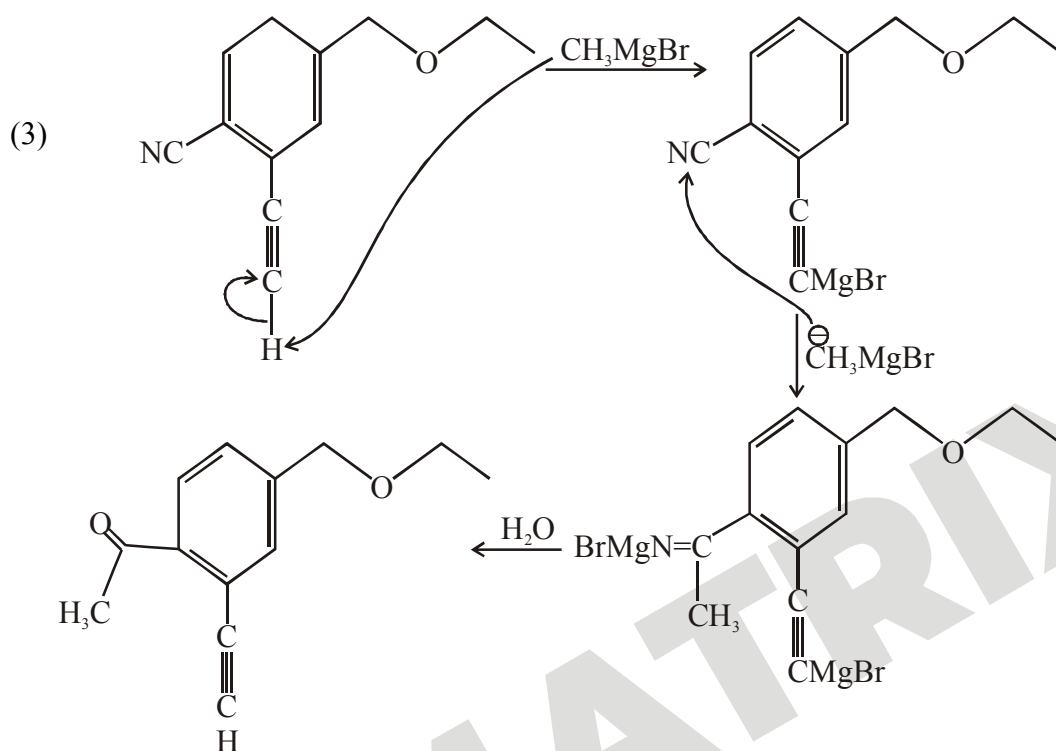


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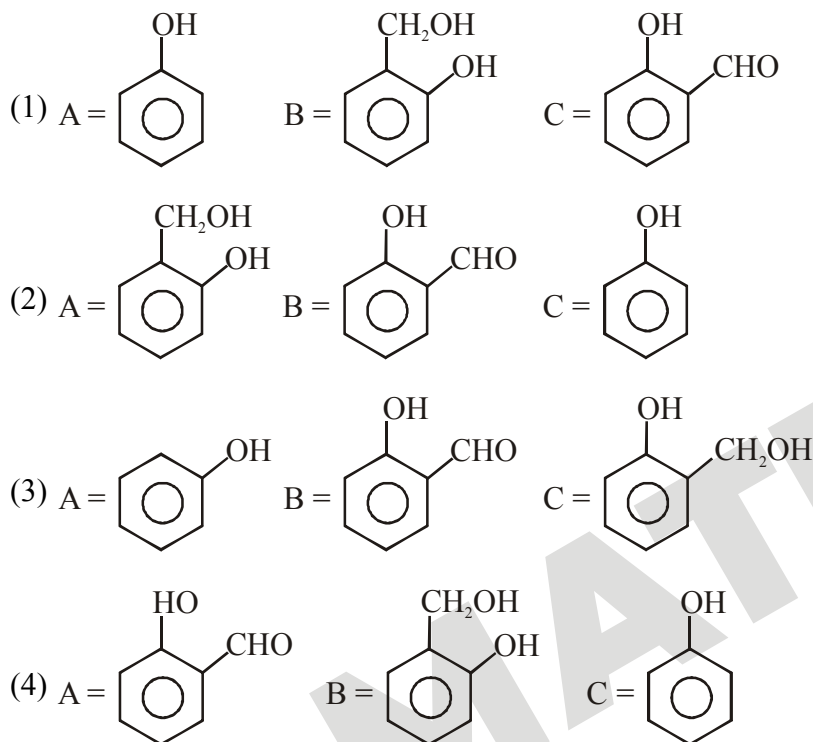
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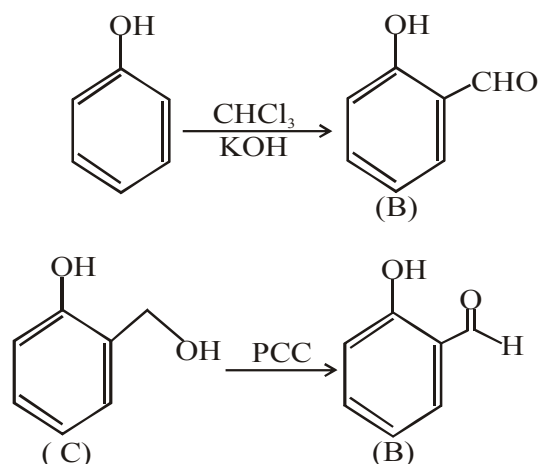
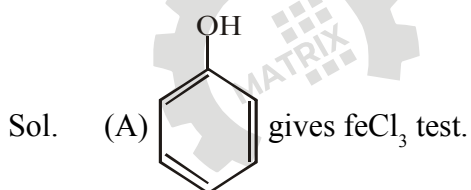


Best possible answer is option (2)

19. 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 C on reaction with pyridinium chlorochromate (PCC). Identify A, B and C.



Ans. Official Answer NTA (3)



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

- (1) Deuterium
- (2) Protium
- (3) Tritium
- (4) Deuterium and Tritium

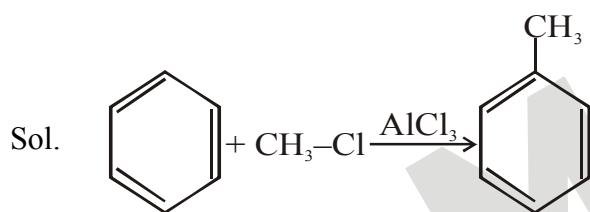
Ans. Official Answer NTA (3)

Sol. Tritium has a half life of 12.3 years.

SECTION - B

1. Methylation of 10 g of benzene gave 9.2 g of toluene. Calculate the percentage yield of toluene _____.
(Nearest integer)

Ans. Official Answer NTA (78)



Theoretical moles of toluene
= moles of benzene taken

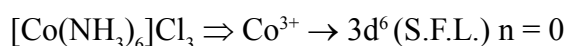
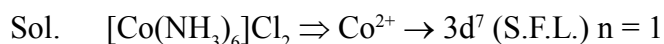
$$= \frac{10}{78} \text{ moles.}$$

$$\% \text{ yield} = \frac{\text{actual mass}}{\text{Theoretical mass}} \times 100$$

$$= \frac{9.2}{\frac{10}{78} \times 92} \times 100 = 78\%$$

2. The total number of unpaired electrons present in $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ and $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is _____.

Ans. Official Answer NTA (1)



Total unpaired electron = 1.



3. 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 : $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$]

Ans. Official Answer NTA (106)

Sol. $a = 0.4518 \text{ nm}$

$d = 7.62 \text{ g/mL}$

$$d = \frac{z \times m}{N_A \times v}$$

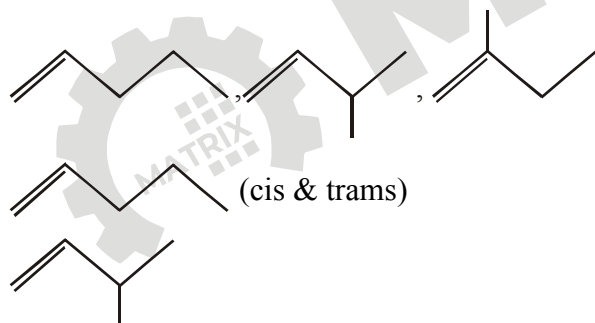
$$M = \frac{7.62 \text{ g/cm}^3 \times 6.022 \times 10^{23} \frac{1}{\text{mol}} \times (0.4518 \times 10^{-17} \text{ cm})^3}{4}$$

$= 105.79 \text{ g/mol.}$

4. The number of acyclic structural isomers (including geometrical isomers) for pentene are _____.

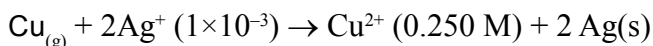
Ans. Official Answer NTA (6)

Sol.



correct answer 6.

5. Assume a cell with the following reaction

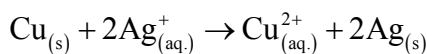
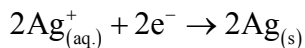
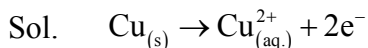


$$E_{\text{cell}}^{\oplus} = 2.97 \text{ V}$$

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

[Given : $\log 2.5 = 0.3979$, $T = 298 \text{ K}$]

Ans. Official Answer NTA (3)



$$n = 2$$

$$E_{\text{cell}}^{\circ} = 2.97\text{V}$$

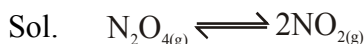
$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{n} \cdot \log \frac{[\text{Cu}^{2+}]}{[\text{Ag}^+]^2}$$

$$= 2.97 - \frac{0.0591}{2} \cdot \log \frac{0.250}{(10^{-3})^2} = 2.81$$

6. Value of K_p for the equilibrium reaction $\text{N}_2\text{O}_{4(g)} \rightleftharpoons 2\text{NO}_{2(g)}$ at 288 K is 47.9. The K_c For this reaction at same temperature is _____. (Nearest integer).

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

Ans. Official Answer NTA (2)



$$\Delta n_g = 2 - 1 = 1$$

$$K_p = K_c (RT)^{\Delta n_g}$$

$$K_c = \frac{47.9}{(0.083 \times 288)} = 2.00$$

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

Ans. Official Answer NTA (21)

Sol. Heat generated on combustion of 1g of graphite powder = $-2.45 \times 10^2 \times \frac{1}{12} = 20.66 \text{ kJ}$

8. If the concentration of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in blood is 0.72 g L^{-1} , the molarity of glucose in blood is _____ $\times 10^{-3} \text{ M}$. (Nearest integer)

Ans. Official Answer NTA (4)

Sol.
$$\text{Molarity} = \frac{\text{Strength (g/L)}}{\text{Molar Mass of solute}}$$

$$= \frac{0.72 \text{ g/L}}{180 \text{ g/mol}}$$

$$= 4 \times 10^{-3} \text{ M}$$

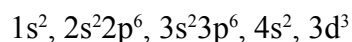
9. Number of electrons that Vanadium ($Z = 23$) has in p-orbitals is equal to _____.

Ans. Official Answer NTA (12)

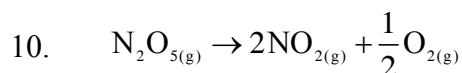
Sol. Vanadium

$$Z = 23$$

electronic configuration :



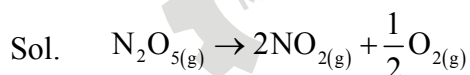
$$\text{electrons in p orbital} = 6 + 6 = 12$$



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

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

Ans. Official Answer NTA (7)



$$k = \frac{2.303}{t} \cdot \log \frac{[\text{N}_2\text{O}_5]_0}{[\text{N}_2\text{O}_5]_t}$$

$$= \frac{2.303}{1 \times 60} \cdot \log \frac{2.40 \times 10^{-2}}{1.60 \times 10^{-2}} \text{ min}^{-1}$$

$$= 6.75 \times 10^{-3} \text{ min}^{-1}$$