

FINAL JEE-MAIN EXAMINATION – AUGUST, 2021

(Held On Tuesday 31st August, 2021)

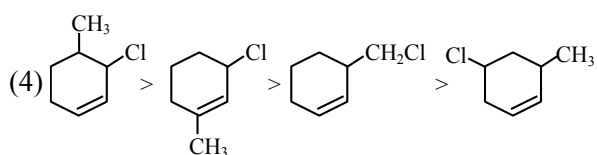
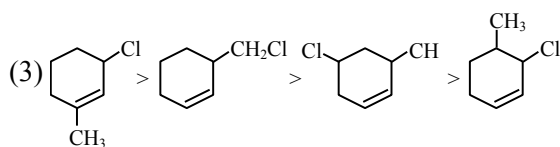
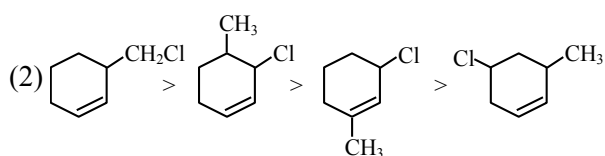
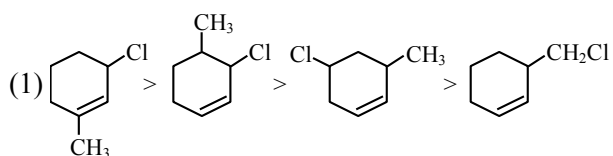
TIME : 9 : 00 AM to 12 : 00 NOON

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

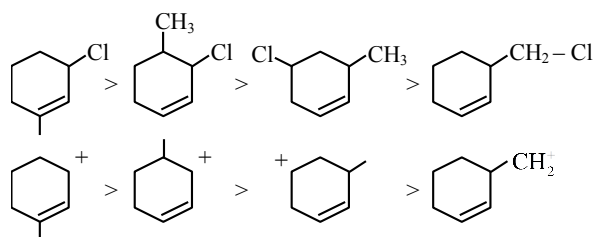
1. The **correct** order of reactivity of the given chlorides with acetate in acetic acid is :



Official Ans. by NTA (1)

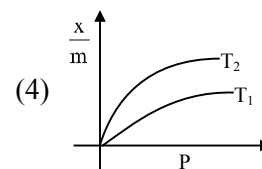
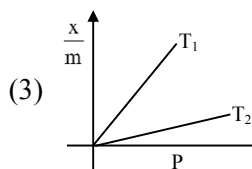
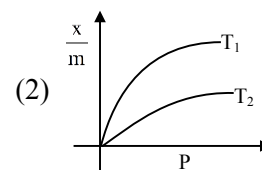
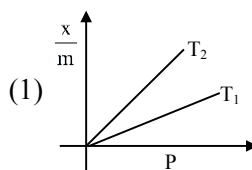
Sol. As it is example of SN^1 .

so carbocation stability \uparrow , reaction rate \uparrow



2. Select the graph that correctly describes the adsorption isotherms at two temperatures T_1 and T_2 ($T_1 > T_2$) for a gas :

(x – mass of the gas adsorbed ; m – mass of adsorbent ; P – pressure)

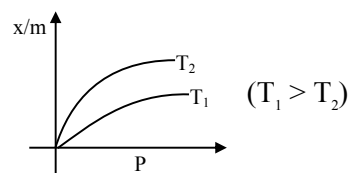


Official Ans. by NTA (4)

Sol. $\frac{x}{m} \propto P^{1/n} \left(0 < \frac{1}{n} < 1 \right)$

On Increasing temperature $\frac{x}{m}$ decreases.

\therefore adsorption is generally exothermic



3. The major component/ingredient of Portland Cement is :

- (1) tricalcium aluminate
- (2) tricalcium silicate
- (3) dicalcium aluminate
- (4) dicalcium silicate

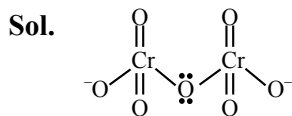
Official Ans. by NTA (2)

Sol. Major component of portland cement is "Tricalcium silicate (51% , $3CaO.SiO_2$)"

4. In the structure of the dichromate ion, there is a :

- (1) linear symmetrical Cr–O–Cr bond.
- (2) non-linear symmetrical Cr–O–Cr bond.
- (3) linear unsymmetrical Cr–O–Cr bond.
- (4) non-linear unsymmetrical Cr–O–Cr bond.

Official Ans. by NTA (2)



dichromate ion contain non-linear symmetrical Cr–O–Cr Bond

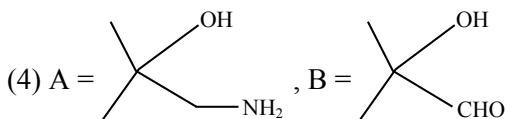
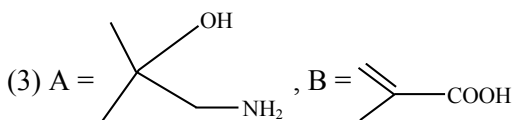
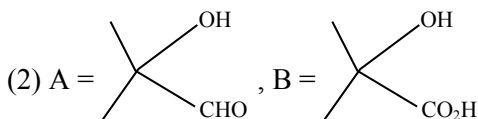
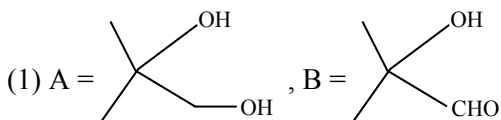
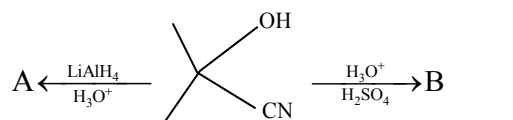
5. Which one of the following compounds contains β -C₁-C₄ glycosidic linkage ?
- (1) Lactose (2) Sucrose
(3) Maltose (4) Amylose

Official Ans. by NTA (1)

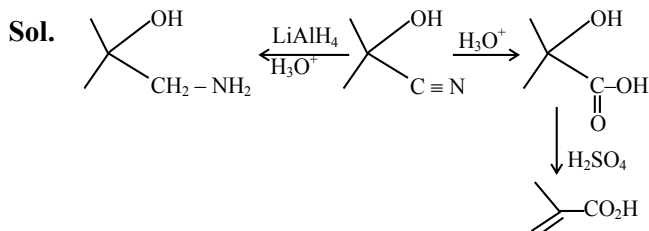
Sol. In Lactose it is β C₁ – C₄ glycosidic linkage.

In Maltose, Amylose α C₁ – C₄ glycosidic linkage is present

6. The major products A and B in the following set of reactions are :



Official Ans. by NTA (3)



7. Which one of the following lanthanides exhibits +2 oxidation state with diamagnetic nature ?
(Given Z for Nd = 60, Yb = 70, La = 57, Ce = 58)
- (1) Nd (2) Yb (3) La (4) Ce

Official Ans. by NTA (2)

Sol. Ytterbium shows +2 oxidation state with diamagnetic nature

So ans is 2

8. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Aluminium is extracted from bauxite by the electrolysis of molten mixture of Al₂O₃ with cryolite.

Reason (R) : The oxidation state of Al in cryolite is +3.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) **(A)** is true but **(R)** is false
(2) **(A)** is false but **(R)** is true.
(3) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**
(4) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**

Official Ans. by NTA (4)

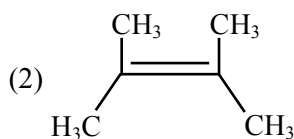
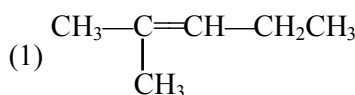
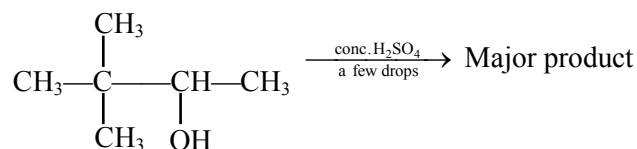
Sol. (A) Aluminium is reactive metal so Aluminium is extracted by electrolysis of Alumina with molten mixture of Cryolite

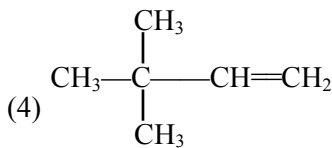
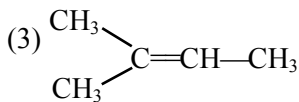
(B) Cryolite, Na₃AlF₆

Here Al is in +3 O.S.

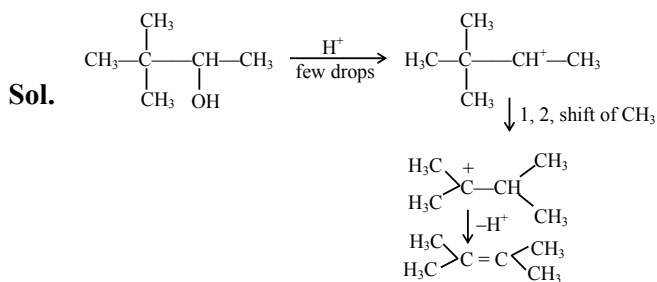
So Answer is 4

9. The major product formed in the following reaction is :





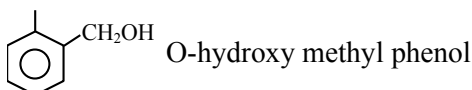
Official Ans. by NTA (2)



10. Monomer of Novolac is :
- (1) 3-Hydroxybutanoic acid
 - (2) phenol and melamine
 - (3) o-Hydroxymethylphenol
 - (4) 1,3-Butadiene and styrene

Official Ans. by NTA (3)

Sol. Monomer of Novolac is



11. Given below are two statements :
- Statement-I** : The process of producing syn-gas is called gasification of coal.
- Statement-II** : The composition of syn-gas is $\text{CO} + \text{CO}_2 + \text{H}_2$ (1 : 1 : 1)
- In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) **Statement-I** is false but **Statement-II** is true
- (2) **Statement-I** is true but **Statement-II** is false
- (3) Both **Statement-I** and **Statement-II** are false
- (4) Both **Statement-I** and **Statement-II** are true

Official Ans. by NTA (2)

Sol. The process of producing syn-gas from coal is called gasification of coal.

Syn-gas having composition of CO & H_2 in 1 : 1

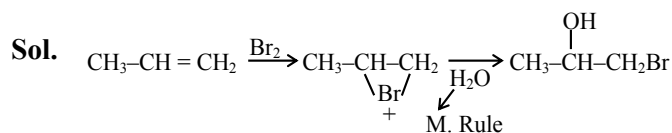
12. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
- Assertion (A)** : Treatment of bromine water with propene yields 1-bromopropan-2-ol.

Reason (R) : Attack of water on bromonium ion follows Markovnikov rule and results in 1-bromopropan-2-ol.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) Both **(A)** and **(R)** are true but **(R)** is NOT the correct explanation of **(A)**
- (2) **(A)** is false but **(R)** is true.
- (3) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**
- (4) **(A)** is true but **(R)** is false

Official Ans. by NTA (3)



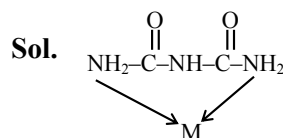
Its IUPAC name 1-bromopropan-2-ol

A and R are true and (R) is the correct explanation of (A)

13. The denticity of an organic ligand, biuret is :

- (1) 2
- (2) 4
- (3) 3
- (4) 6

Official Ans. by NTA (1)



Biuret :- Bidentate ligand

The denticity of organic ligand is 2.

14. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Metallic character decreases and non-metallic character increases on moving from left to right in a period.

Reason (R) : It is due to increase in ionisation enthalpy and decrease in electron gain enthalpy, when one moves from left to right in a period.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) (A) is false but (R) is true.
 (2) (A) is true but (R) is false
 (3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
 (4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

Official Ans. by NTA (2)

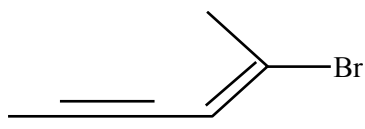
Sol. From left to right in periodic table :-

Metallic character decreases

Non-metallic character increases

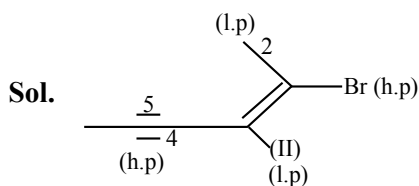
⇒ It is due to increase in ionization enthalpy and increase in electron gain enthalpy.

15. Choose the **correct** name for compound given below :



- (1) (4E)-5-Bromo-hex-4-en-2-yne
 (2) (2E)-2-Bromo-hex-4-yn-2-ene
 (3) (2E)-2-Bromo-hex-2-en-4-yne
 (4) (4E)-5-Bromo-hex-2-en-4-yne

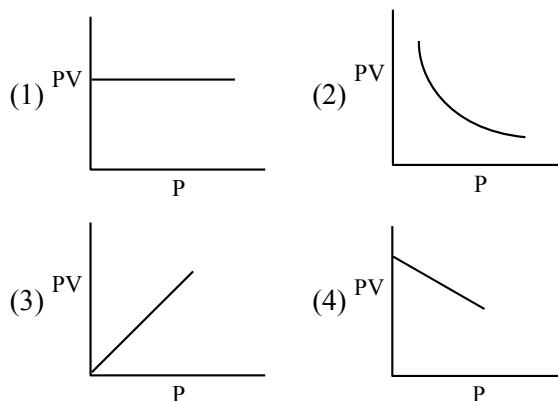
Official Ans. by NTA (3)



h.p. ⇒ higher priority
 l.p. ⇒ lower priority

2E -2- bromo hex -2- en-4-yne

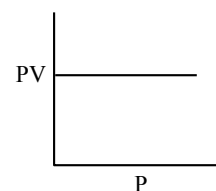
16. Which one of the following is the correct PV vs P plot at constant temperature for an ideal gas ? (P and V stand for pressure and volume of the gas respectively)



Official Ans. by NTA (1)

Sol. $PV = nRT$ (n,T constant)

$PV = \text{constant}$



17. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)** :

Assertion (A) : A simple distillation can be used to separate a mixture of propanol and propanone.

Reason (R) : Two liquids with a difference of more than 20°C in their boiling points can be separated by simple distillations.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) (A) is false but (R) is true.
 (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Official Ans. by NTA (4)

Sol. Both assertion & reason are correct & (R) is the correct explanation of (A)

18. Which one of the following 0.10 M aqueous solutions will exhibit the largest freezing point depression ?

- (1) hydrazine (2) glucose
(3) glycine (4) KHSO_4

Official Ans. by NTA (4)

18. \therefore Van't Hoff factor is highest for KHSO_4

\therefore colligative property (ΔT_f) will be highest for KHSO_4

19. BOD values (in ppm) for clean water (A) and polluted water (B) are expected respectively :

- (1) $A > 50, B < 27$ (2) $A > 25, B < 17$
(3) $A < 5, B > 17$ (4) $A > 15, B > 47$

Official Ans. by NTA (3)

Sol. BOD values of clean water (A) is less than 5 ppm

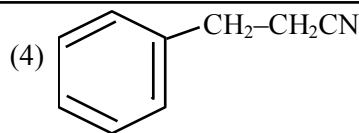
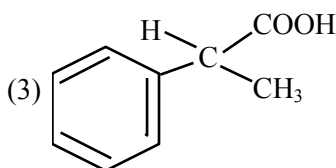
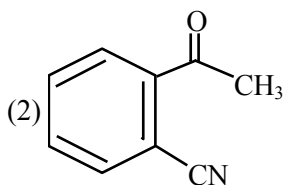
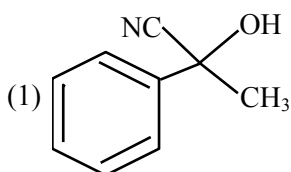
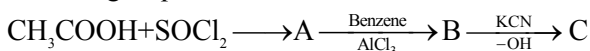
So $A < 5$

BOD values of polluted water (B) is greater than 17 ppm

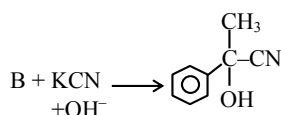
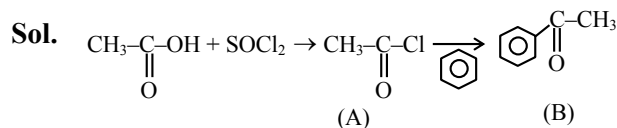
So $B > 17$

So Ans. is 3

20. The structure of product C, formed by the following sequence of reactions is :

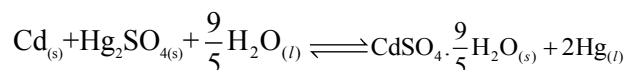


Official Ans. by NTA (1)



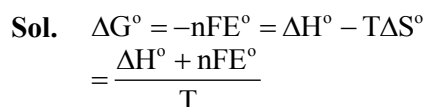
SECTION-B

1. Consider the following cell reaction :



The value of E_{cell}^0 is 4.315 V at 25°C . If $\Delta H^\circ = -825.2 \text{ kJ mol}^{-1}$, the standard entropy change ΔS° in J K^{-1} is _____. (Nearest integer)
[Given : Faraday constant = 96487 C mol^{-1}]

Official Ans. by NTA (25)



$$= \frac{(-825.2 \times 10^3) + (2 \times 96487 \times 4.315)}{298}$$

$$= \frac{-825.2 \times 10^3 + 832.682 \times 10^3}{298}$$

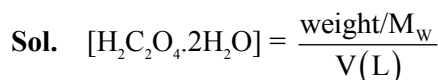
$$= \frac{7.483 \times 10^3}{298} = 25.11 \text{ JK}^{-1}\text{mol}^{-1}$$

\therefore Nearest integer answer is 25

2. The molarity of the solution prepared by dissolving 6.3 g of oxalic acid ($\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$) in 250 mL of water in mol L^{-1} is $x \times 10^{-2}$. The value of x is _____ (Nearest integer)

[Atomic mass : H : 1.0, C : 12.0, O : 16.0]

Official Ans. by NTA (20)



$$\Rightarrow x \times 10^{-2} = \frac{6.3 / 126}{250 / 1000}$$

$x = 20$

3. Consider the sulphides HgS, PbS, CuS, Sb₂S₃, As₂S₃ and CdS. Number of these sulphides soluble in 50% HNO₃ is _____.

Official Ans. by NTA (4)

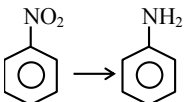
Sol. Pbs, CuS, As₂S₃, CdS are soluble in 50% HNO₃
HgS, Sb₂S₃ are insoluble in 50% HNO₃

So Answer is 4.

4. The total number of reagents from those given below, that can convert nitrobenzene into aniline is _____. (Integer answer)

- I. Sn – HCl
- II. Sn – NH₄OH
- III. Fe – HCl
- IV. Zn – HCl
- V. H₂ – Pd
- VI. H₂ – Raney Nickel

Official Ans. by NTA (5)

Sol.  Reagents used can be

- (i) Sn + HCl
- (ii) Fe + HCl
- (iii) Zn + HCl
- (iv) H₂ – Pd
- (v) H₂ (Raney Ni)

5. The number of halogen/(s) forming halic (V) acid is _____.

Official Ans. by NTA (3)

Sol. The number of halogen forming halic (V) acid

- HClO₃
- HBrO₃
- HIO₃

So Answer is 3

6. For a first order reaction, the ratio of the time for 75% completion of a reaction to the time for 50% completion is _____. (Integer answer)

Official Ans. by NTA (2)

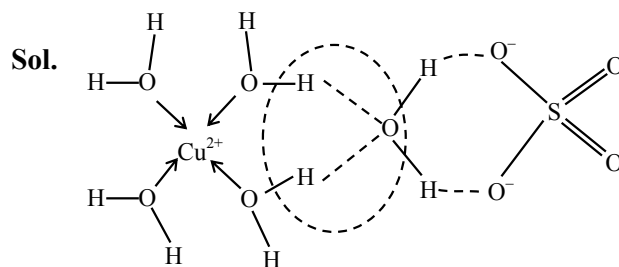
Sol. $k = \frac{2.303}{t} \log \frac{a}{a-x}$

$$\frac{2.303}{t_{50\%}} \log \frac{100}{100-50} = \frac{2.303}{t_{75\%}} \log \frac{100}{100-75}$$

$$t_{75\%} = 2 t_{50\%}$$

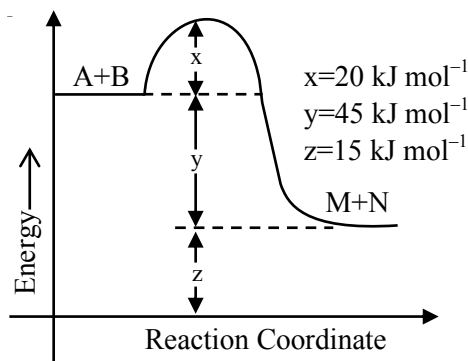
7. The number of hydrogen bonded water molecule(s) associated with stoichiometry CuSO₄·5H₂O is _____.

Official Ans. by NTA (1)



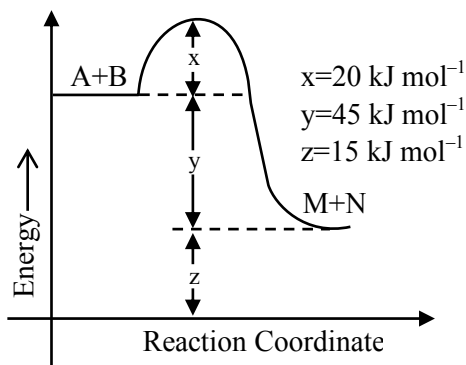
One hydrogen bonded H₂O molecule

8. According to the following figure, the magnitude of the enthalpy change of the reaction A + B → M + N in kJ mol⁻¹ is equal to _____. (Integer answer)



Official Ans. by NTA (45)

Sol.



$$\Delta H = E_{a_r} - E_{a_b}$$

$$= 20 - 65$$

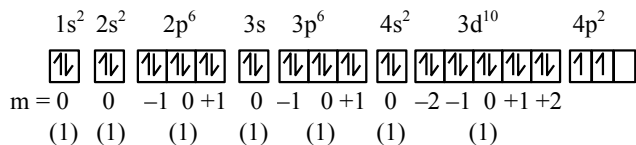
$$= -45 \text{ KJ/mol}$$

$$|\Delta H| = 45 \text{ KJ/mol}$$

9. Ge(Z = 32) in its ground state electronic configuration has x completely filled orbitals with $m_l = 0$. The value of x is _____.

Official Ans. by NTA (7)

Sol.



Completely filled orbital with $m_l = 0$ are

$$= 1+1+1+1+1+1+1$$

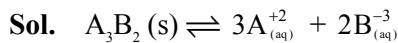
$$= 7$$

So Answer is 7

10. A_3B_2 is a sparingly soluble salt of molar mass M (g mol^{-1}) and solubility x g L^{-1} . The solubility product satisfies $K_{sp} = a \left(\frac{x}{M} \right)^5$. The value of a is

_____ (Integer answer)

Official Ans. by NTA (108)



$$K_{sp} = (3s)^3 (2s)^2$$

$$K_{sp} = 108 S^5 \text{ \& } s = (X/M)$$

$$K_{sp} = 108 \left(\frac{x}{m} \right)^5$$

$$\text{given } K_{sp} = a \left(\frac{x}{m} \right)^5$$

$$\text{comparing } a = 108$$