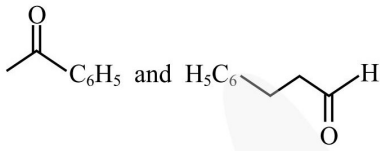
FINAL JEE–MAIN EXAMINATION – JULY, 2021
Held On Tuesday 20th July, 2021
TIME: 3:00 PM to 06:00 PM

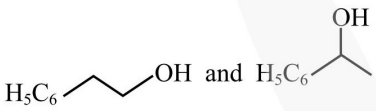
SECTION-A

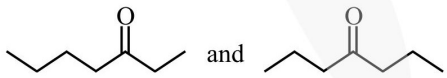
1. Which one of the following pairs of isomers is an example of metamerism ?

(1) $CH_3CH_2CH_2CH_2CH_3$ and $H_3C-\underset{\underset{CH_3}{|}}{\overset{\overset{CH}{|}}{C}}-CH_3$

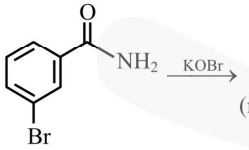
80

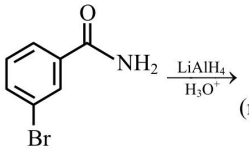
(2)  and

(3) 

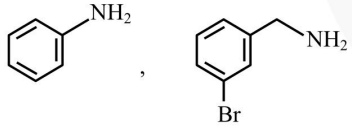
(4) 

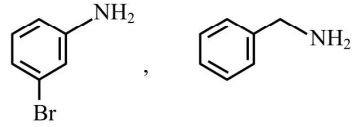
Official Ans. by NTA (4)

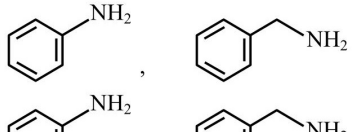
2. 
A
(major product)

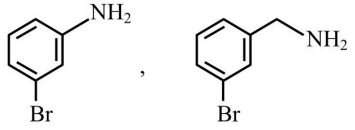

B
(major product)

In the above reactions, product A and product B respectively are :

(1) 

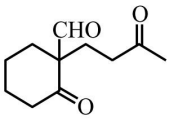
(2) 

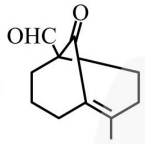
(3) 

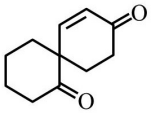
(4) 

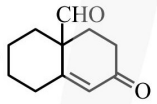
Official Ans. by NTA (4)

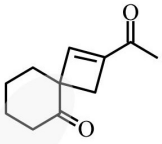
3. The major product (P) in the following reaction is :


(i) KOH (alc.)
(ii) H^+, Δ
P
(major product)

(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (2)

4. The single largest industrial application of dihydrogen is :

(1) Manufacture of metal hydrides
(2) Rocket fuel in space research
(3) In the synthesis of ammonia
(4) In the synthesis of nitric acid

Official Ans. by NTA (3)

5. Consider two chemical reactions (A) and (B) that take place during metallurgical process :

(A) $ZnCO_{3(s)} \xrightarrow{\Delta} ZnO_{(s)} + CO_{2(g)}$

(B) $2ZnS_{(s)} + 3O_{2(g)} \xrightarrow{\Delta} 2ZnO_{(s)} + 2SO_{2(g)}$

The **correct** option of names given to them respectively is :

(1) (A) is calcination and (B) is roasting
(2) Both (A) and (B) are producing same product so both are roasting
(3) Both (A) and (B) are producing same product so both are calcination
(4) (A) is roasting and (B) is calcination

Official Ans. by NTA (1)

6. A solution is 0.1 M in Cl^- and 0.001 M in CrO_4^{2-}. Solid $AgNO_3$ is gradually added to it
Assuming that the addition does not change in volume and $K_{sp}(AgCl) = 1.7 \times 10^{-10}\ M^2$ and $K_{sp}(Ag_2CrO_4) = 1.9 \times 10^{-12}\ M^3$.
Select **correct** statement from the following :
(1) AgCl precipitates first because its K_{sp} is high.
(2) Ag_2CrO_4 precipitates first as its K_{sp} is low.
(3) Ag_2CrO_4 precipitates first because the amount of Ag^+ needed is low.
(4) AgCl will precipitate first as the amount of Ag^+ needed to precipitate is low.
Official Ans. by NTA (4)

7. Outermost electronic configuration of a group 13 element, E, is $4s^2, 4p^1$. The electronic configuration of an element of p-block period-five placed diagonally to element, E is :
(1) [Kr] $3d^{10}\ 4s^2\ 4p^2$ (2) [Ar] $3d^{10}\ 4s^2\ 4p^2$
(3) [Xe] $5d^{10}\ 6s^2\ 6p^2$ (4) [Kr] $4d^{10}\ 5s^2\ 5p^2$
Official Ans. by NTA (4)

8. Metallic sodium does not react normally with :
(1) gaseous ammonia (2) But-2-yne
(3) Ethyne (4) tert-butyl alcohol
Official Ans. by NTA (2)

9. Spin only magnetic moment of an octahedral complex of Fe^{2+} in the presence of a strong field ligand in BM is :
(1) 4.89 (2) 2.82 (3) 0 (4) 3.46
Official Ans. by NTA (3)

10. Which one of the following species **doesn't** have a magnetic moment of 1.73 BM, (spin only value) ?
(1) O_2^+ (2) CuI
(3) $[Cu(NH_3)_4]Cl_2$ (4) O_2^-
Official Ans. by NTA (2)

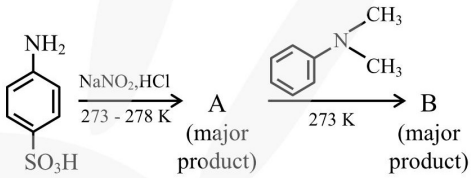
11. Which one of the following statements is not true about enzymes ?
(1) Enzymes are non-specific for a reaction and substrate.
(2) Almost all enzymes are proteins.
(3) Enzymes work as catalysts by lowering the activation energy of a biochemical reaction.
(4) The action of enzymes is temperature and pH specific
Official Ans. by NTA (1)

12. The hybridisations of the atomic orbitals of nitrogen in NO_2^-, NO_2^+ and NH_4^+ respectively are.
(1) sp^3, sp^2 and sp (2) sp, sp^2 and sp^3
(3) sp^3, sp and sp^2 (4) sp^2, sp and sp^3
Official Ans. by NTA (4)

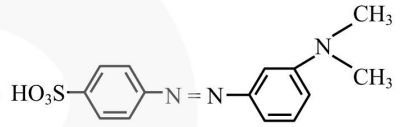
13. Bakelite is a cross-linked polymer of formaldehyde and :
(1) PHBV (2) Buna-S (3) Novolac (4) Dacron
Official Ans. by NTA (3)

14. Benzene on nitration gives nitrobenzene in presence of HNO_3 and H_2SO_4 mixture, where :
(1) both H_2SO_4 and HNO_3 act as a bases
(2) HNO_3 acts as an acid and H_2SO_4 acts as a base
(3) both H_2SO_4 and HNO_3 act as an acids
(4) HNO_3 acts as a base and H_2SO_4 acts as an acid
Official Ans. by NTA (4)

15.



Consider the above reaction, compound B is :

(1)


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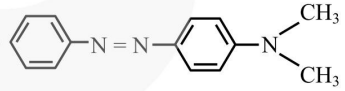

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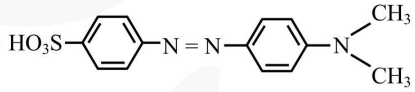

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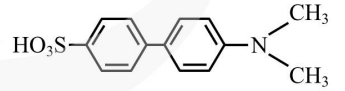
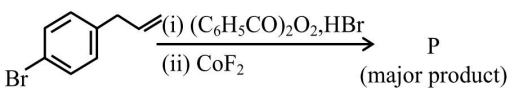
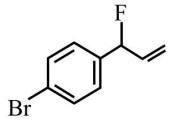
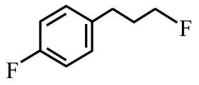


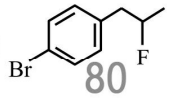
Official Ans. by NTA (3)

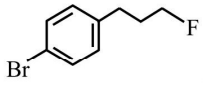
16. 

Major product P of above reaction, is :

(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (4)

17. Cu^{2+} salt reacts with potassium iodide to give

(1) Cu_2I_2 (2) Cu_2I_3 (3) CuI (4) $Cu(I_3)_2$

Official Ans. by NTA (1)

ALLEN Ans. (1, 3)

18. In Carius method, halogen containing organic compound is heated with fuming nitric acid in the presence of :

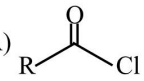
(1) HNO_3 (2) $AgNO_3$ (3) $CuSO_4$ (4) $BaSO_4$

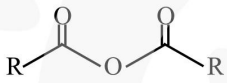
Official Ans. by NTA (2)

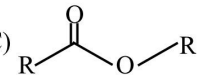
19. Which one of the following gases is reported to retard photosynthesis ?

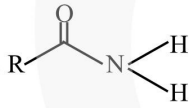
(1) CO (2) CFCs (3) CO_2 (4) NO_2

Official Ans. by NTA (4)

20. (A) 

(B) 

(C) 

(D) 

The **correct** order of their reactivity towards hydrolysis at room temperature is :

(1) (A) > (B) > (C) > (D)

(2) (D) > (A) > (B) > (C)

(3) (D) > (B) > (A) > (C)

(4) (A) > (C) > (B) > (D)

Official Ans. by NTA (1)

SECTION-B

1. For a given chemical reaction A → B at 300 K the free energy change is –49.4 kJ mol^{-1} and the enthalpy of reaction is 51.4 kJ mol^{-1}. The entropy change of the reaction is _____ J K^{-1} mol^{-1}.

Official Ans. by NTA (360)

2. The wavelength of electrons accelerated from rest through a potential difference of 40 kV is $x \times 10^{-12}$ m. The value of x is _____. (Nearest integer)

Given : Mass of electron = 9.1×10^{-31} kg

Charge on an electron = 1.6×10^{-19} C

Planck's constant = 6.63×10^{-34} Js

Official Ans. by NTA (6)

3. The vapour pressures of A and B at 25°C are 90 mm Hg and 15 mm Hg respectively. If A and B are mixed such that the mole fraction of A in the mixture is 0.6, then the mole fraction of B in the vapour phase is $x \times 10^{-1}$. The value of x is _____. (Nearest integer)

Official Ans. by NTA (1)

4. 4g equimolar mixture of NaOH and Na_2CO_3 contains x g of NaOH and y g of Na_2CO_3. The value of x is _____ g. (Nearest integer)

Official Ans. by NTA (1)

5. When 0.15 g of an organic compound was analyzed using Carius method for estimation of bromine, 0.2397 g of AgBr was obtained. The percentage of bromine in the organic compound is _____. (Nearest integer)

[Atomic mass : Silver = 108, Bromine = 80]

Official Ans. by NTA (68)

6. 100 ml of 0.0018% (w/v) solution of Cl^- ion was the minimum concentration of Cl^- required to precipitate a negative sol in one h. The coagulating value of Cl^- ion is _____ (Nearest integer)

Official Ans. by NTA (1)

ALLEN Ans. (Bonus)

7. $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$

In the above first order reaction the concentration of PCl_5 reduces from initial concentration 50 mol L^{-1} to 10 mol L^{-1} in 120 minutes at 300 K. The rate constant for the reaction at 300 K is $x \times 10^{-2}$ min^{-1}. The value of x is _____. [Given log5 = 0.6989]

Official Ans. by NTA (1)

8. Diamond has a three dimensional structure of C atoms formed by covalent bonds. The structure of diamond has face centred cubic lattice where 50% of the tetrahedral voids are also occupied by carbon atoms. The number of carbon atoms present per unit cell of diamond is _____.

Official Ans. by NTA (8)

9. An aqueous solution of $NiCl_2$ was heated with excess sodium cyanide in presence of strong oxidizing agent to form $[Ni(CN)_6]^{2-}$. The total change in number of unpaired electrons on metal centre is _____.

Official Ans. by NTA (2)

10. Potassium chlorate is prepared by electrolysis of KCl in basic solution as shown by following equation.

$6OH^- + Cl^- \rightarrow ClO_3^- + 3H_2O + 6e^-$

A current of xA has to be passed for 10h to produce 10.0g of potassium chlorate. the value of x is _____. (Nearest integer)

(Molar mass of $KClO_3$ = 122.6 g mol^{-1},
F = 96500 C)

Official Ans. by NTA (1)