FINAL JEE–MAIN EXAMINATION – JANUARY, 2020

(Held On Wednesday 08th JANUARY, 2020) TIME : 2 : 30 PM to 5 : 30 PM

CHEMISTRY

TEST PAPER WITH ANSWER

1. Among the reactions (a) - (d), the reaction(s) that does/do not occur in the blast furnace during the extraction of iron is/are :

(a) $CaO + SiO_2 \rightarrow CaSiO_3$

(b) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$

(c) $FeO + SiO_2 \rightarrow FeSiO_3$

(d) $FeO \rightarrow Fe + \frac{1}{2}O_2$

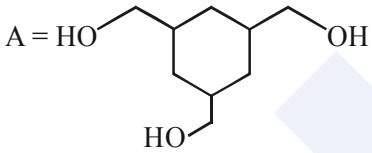
(1) (c) and (d) (2) (a) and (d)

(3) (d) (4) (a)

NTA Ans. (1)

ALLEN Ans. (1)

2. Among the compounds A and B with molecular formula $C_9H_{18}O_3$, A is having higher boiling point the B. The possible structures of A and B are :



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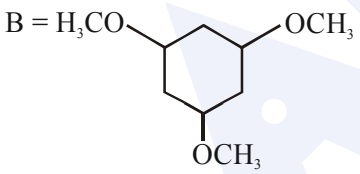

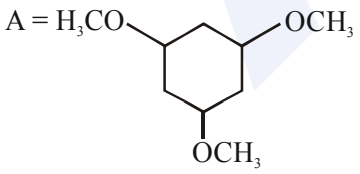

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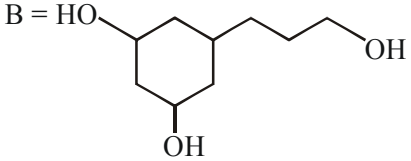

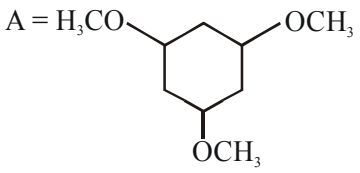

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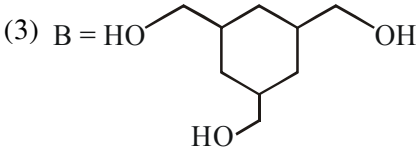

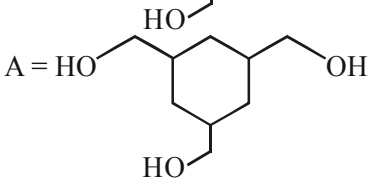

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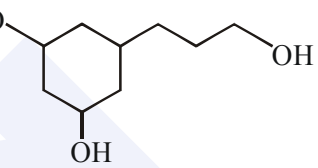
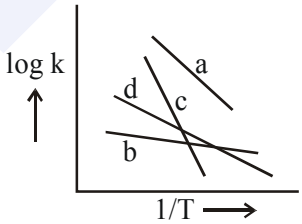


NTA Ans. (1)

ALLEN Ans. (1)

3. Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. Which of the following orders is correct for the activation energies of these reactions?



(1) $E_b > E_d > E_c > E_a$ (2) $E_a > E_c > E_d > E_b$

(3) $E_c > E_a > E_d > E_b$ (4) $E_b > E_a > E_d > E_c$

NTA Ans. (3)

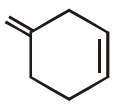
ALLEN Ans. (3)

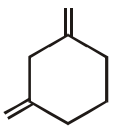
4. An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenattion, and also gives following reaction :

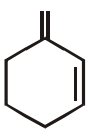
$$X \xrightarrow[Zn/H_2O]{O_3} A \xrightarrow{[Ag(NH_3)_2]^+}$$

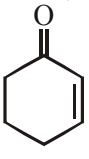
B(3 - oxo - hexanedicarboxylic acid)

X will be :-

(1) 

(2) 

(3) 

(4) 

NTA Ans. (1)

ALLEN Ans. (1)

5. The increasing order of the atomic radii of the following elements is :-

(a) C (b) O (c) F (d) Cl (e) Br

(1) (b) < (c) < (d) < (a) < (e)

(2) (a) < (b) < (c) < (d) < (e)

(3) (d) < (c) < (b) < (a) < (e)

(4) (c) < (b) < (a) < (d) < (e)

NTA Ans. (4)

ALLEN Ans. (4)

6. Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?

(1) $C_6H_5NO_2$ (2) $C_6H_5NH_2$

(3) $CH_3CH_2-C\equiv N$ (4) $NH_2-\overset{\overset{O}{\|}}{C}-NH_2$

NTA Ans. (1)

ALLEN Ans. (1)

7. The major product [B] in the following sequence of reactions is :-

$$CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3 \xrightarrow[(ii)\ H_2O_2,OH^{\ominus}]{(i)\ B_2H_6} [A] \xrightarrow[\Delta]{dil.\ H_2SO_4} [B]$$

(1) $CH_3-\underset{\underset{H_3C \quad CH_3}{\diagup \diagdown}}{\overset{\overset{CH_2CH_2CH_3}{|}}{C}}=O$

(2) $CH_2=\underset{\underset{CH(CH_3)_2}{|}}{C}-CH_2CH_2CH_3$

(3) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{CH}-CH=CH-CH_3$

(4) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3$

NTA Ans. (1)

ALLEN Ans. (1)

8. A metal (A) on heating in nitrogen gas gives compound B. B on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a dark blue-violet coloured solution. A and B respectively, are :

(1) Mg and Mg_3N_2 (2) Na and $NaNO_3$

(3) Mg and $Mg(NO_3)_2$ (4) Na and Na_3N

NTA Ans. (1)

ALLEN Ans. (1)

9. Which of the following compounds is likely to show both Frenkel and Schottky defects in its crystalline form?

(1) AgBr (2) ZnS (3) KBr (4) CsCl

NTA Ans. (1)

ALLEN Ans. (1)

10. For the following Assertion and Reason, the correct option is :

Assertion : The pH of water increases with increase in temperature.

Reason : The dissociation of water into H^+ and OH^- is an exothermic reaction.

(1) Both assertion and reason are true, but the reason is not the correct explanation for the assertion.

(2) Both assertion and reason are false.

(3) Assertion is not true, but reason is true.

(4) Both assertion and reason are true, and the reason is the correct explanation for the assertion.

NTA Ans. (2)

ALLEN Ans. (2)

11. Arrange the following bonds according to their average bond energies in descending order :

C–Cl, C–Br, C–F, C–I

(1) C–I > C–Br > C–Cl > C–F

(2) C–Br > C–I > C–Cl > C–F

(3) C–F > C–Cl > C–Br > C–I

(4) C–Cl > C–Br > C–I > C–F

NTA Ans. (3)

ALLEN Ans. (3)

12. White Phosphorus on reaction with concentrated NaOH solution in an inert atmosphere of CO_2 gives phosphine and compound (X). (X) on acidification with HCl gives compound (Y). The basicity of compound (Y) is :

(1) 4 (2) 1

(3) 2 (4) 3

NTA Ans. (2)

ALLEN Ans. (2)

13. The radius of the second Bohr orbit, in terms of the Bohr radius, a_0, in Li^{2+} is :

(1) $\frac{4a_0}{9}$ (2) $\frac{2a_0}{9}$

(3) $\frac{2a_0}{3}$ (4) $\frac{4a_0}{3}$

NTA Ans. (4)

ALLEN Ans. (4)

14. Among (a) – (d) the complexes that can display geometrical isomerism are :

(a) $[Pt(NH_3)_3Cl]^+$

(b) $[Pt(NH_3)Cl_5]^-$

(c) $[Pt(NH_3)_2Cl(NO_2)]$

(d) $[Pt(NH_3)_4ClBr]^{2+}$

(1) (d) and (a) (2) (a) and (b)

(3) (b) and (c) (4) (c) and (d)

NTA Ans. (4)

ALLEN Ans. (4)

15. Two monomers in maltose are :

(1) α-D-glucose and β-D-glucose

(2) α-D-glucose and α-D-Fructose

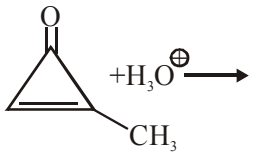
(3) α-D-glucose and α-D-glucose

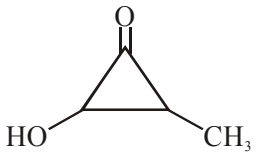
(4) α-D-glucose and α-D-galactose

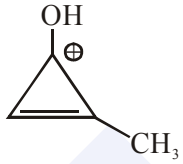
NTA Ans. (3)

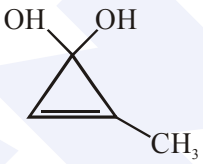
ALLEN Ans. (3)

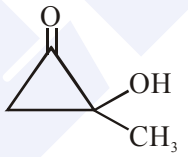
16. The major product in the following reaction is:



(1) 

(2) 

(3) 

(4) 

NTA Ans. (2)

ALLEN Ans. (2)

17. Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) an (z) is :

(1) 4 (2) 3 (3) 2 (4) 1

NTA Ans. (2)

ALLEN Ans. (2)

18. Preparation of Bakelite proceeds via reactions.

(1) Condensation and elimination

(2) Electrophilic addition and dehydration

(3) Electrophilic substitution and dehydration

(4) Nucleophilic addition and dehydration

NTA Ans. (3)

ALLEN Ans. (3)

19. For the following Assertion and Reason, the correct option is

Assertion : For hydrogenation reactions, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7-9 elements.

Reason : The reactants are most strongly adsorbed on group 7-9 elements.

(1) Both assertion and reason are true but the reason is not the correct explanation for the assertion.

(2) Both assertion and reason are false.

(3) Both assertion and reason are true and the reason is the correct explanation for the assertion.

(4) The assertion is true, but the reason is false.

NTA Ans. (4)

ALLEN Ans. (4)

20. The correct order of the calculated spin-only magnetic moments of complexes (A) to (D) is:

(A) $Ni(CO)_4$ (B) $[Ni(H_2O)_6]Cl_2$

(C) $Na_2[Ni(CN)_4]$ (D) $PdCl_2(PPh_3)_2$

(1) (A) ≈ (C) ≈ (D) < (B)

(2) (A) ≈ (C) < (B) ≈ (D)

(3) (C) < (D) < (B) < (A)

(4) (C) ≈ (D) < (B) < (A)

NTA Ans. (1)

ALLEN Ans. (1)

21. For an electrochemical cell

$Sn(s)\,|\,Sn^{2+}(aq,1M)||Pb^{2+}(aq,1M)|Pb(s)$

the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is _____.

(Given $E^0_{Sn^{2+}|Sn} = -0.14V$,

$E^0_{Pb^{2+}|Pb} = -0.13V, \frac{2.303RT}{F} = 0.06$)

NTA Ans. (2.13 to 2.16)

ALLEN Ans. (2.15)

22. At constant volume, 4 mol of an ideal gas when heated from 300 K to 500K changes its internal energy by 5000 J. The molar heat capacity at constant volume is _____.

NTA Ans. (6.25 to 6.25)

ALLEN Ans. (6.25)

23. $NaClO_3$ is used, even in spacecrafts, to produce O_2. The daily consumption of pure O_2 by a person is 492L at 1 atm, 300K. How much amount of $NaClO_3$, in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K ?

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

$R = 0.082\ L\ atm\ mol^{-1}\ K^{-1}$

NTA Ans. (2120 to 2140)

ALLEN Ans. (2130)

24. In the following sequence of reactions the maximum number of atoms present in molecule 'C' in one plane is _____.

$$A \xrightarrow[Cu\ tube]{Red\ hot} B \xrightarrow[Anhydrous\ AlCl_3]{CH_3Cl(1.eq.)} C$$

(A is a lowest molecular weight alkyne)

NTA Ans. (13 to 13)

ALLEN Ans. (13)

25. Complexes (ML_5) of metals Ni and Fe have ideal square pyramidal and trigonal bipyramidal grometries, respectively. The sum of the 90°, 120° and 180° L-M L angles in the two complexes is _____.

NTA Ans. (20 to 20)

ALLEN Ans. (20)