



JEE (Main)

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2021

COMPUTER BASED TEST (CBT)

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Date: 20 July, 2021 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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(GEN-EWS)
AIR-15
DHANANJAY



Zonal Topper
IIT-Kharagpur
AIR-25
SAMARTH



2nd Rank in
IIT-Kharagpur Zone
AIR-29
SANKALP



AIR-30
AARYAN K.



AIR-41
UTKARSH P.

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Classroom: 11047 | Distance: 3708

NEET 2020

2646
Classroom: 1823 | Distance: 811

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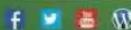
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| JEE MAIN-2021 | DATE : 20-07-2021 (SHIFT-2) | PAPER-1 | MEMORY BASED | CHEMISTRY

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1. 4 gram mixture of NaOH and Na₂CO₃ is equimolar, if it contain X gram of NaOH and Y gram of Na₂CO₃, then value of 'X' is

Ans. (1)

Sol. Given (i) X + Y = 4

$$(ii) \frac{X}{40} = \frac{Y}{106} \text{ [Equimolar]}$$

$$Y = \left[\frac{106}{40} \right] X$$

$$\text{So } X + \frac{106}{40} X = 4$$

$$X + 2.65X = 4$$

$$3.65X = 4$$

$$X = 1.096 \text{ gram}$$

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2. What is the correct relation between degree of freedom and γ ?

(1) $\left(1 + \frac{2}{F}\right)$

(2) $1 + \frac{F}{2}$

(3) $\frac{F}{2}$

(4) $\frac{2}{F}$

Ans. (1)

Sol. $\frac{C_p}{C_v} = \gamma$

$$(F - 1) \gamma$$

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$$\frac{\left(\frac{F}{2}+1\right)R}{\left(\frac{F}{2}\right)R} = \gamma$$

$$\left(\frac{F}{2}+1\right) = \gamma \left[\frac{F}{2}\right]$$

$$R = 1 + \frac{2}{F}$$

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Q. In a paramagnetic complex of Fe²⁺ in high spin state what is the magnetic moment (spin only)

- (1) 4.89 BM (2) 1.73BM (3) 0 BM (4) 3.87BM

Ans. (1)

Sol. $^{26}\text{Fe}^{2+} = 3d^6 4s^0 \Rightarrow t_{2g}^{2,1,1}, e_g^{1,1}$

Unpaired e- [n= 4]

$$\mu = \sqrt{n(n+2)} = \sqrt{24} \\ = 4.89 \text{ BM}$$

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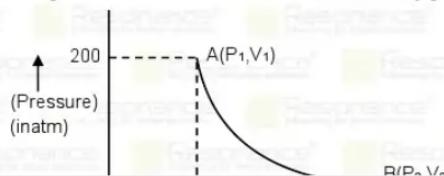
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4. An ideal gas change state from A to state B. Find work done by gas (in KJ) using following P-V diagram



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Ans. (2.8)

Sol. As $P_1V_1 = P_2V_2$ So reversible isothermal process

$$W = -nRT \ln \left(\frac{V_2}{V_1} \right) = -P_1V_1 \ln \left(\frac{V_2}{V_1} \right) = -200 \times 2 \ln \left(\frac{4}{2} \right)$$

$$= -2.303 \times 400 \log 2 = -2.303 \times 400 \times 0.3$$

$$= -276.36 \text{ atm} \times \text{lit} = -28002 \text{ J} = -2.8 \text{ KJ}$$

Work done by gas = 2.8 KJ

5. An ideal solution is prepared by mixing of A ($P_A^0 = 90$ torr) and B ($P_B^0 = 15$ torr) in which mole fraction of A in liquid phase is 0.6, Then mole fraction of B in vapour phase is $[X] \times 10^{-1}$. Then Volume of X is

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$$\text{Sol. } X_A + X_B = 1 \quad \begin{cases} X_A = 0.6 \\ X_B = 0.4 \end{cases}$$

$$P_{\text{Total}} = P_A^0 X_A + P_B^0 X_B$$

$$= [90] 0.6 + [15] 0.4 = 54 + 6 = 60 \text{ torr}$$

$$P_B = P_B^0 X_B = [P_{\text{TOTAL}}] Y_B$$

$$Y_B = \frac{15 \times 0.4}{60} = 0.1$$

$$\text{Ans. } 1 \times 10^{-1}$$

6. What is the difference in number of unpaired electron when NiCl_2 change into $[\text{Ni}(\text{CN})_6]^{2-}$

Ans. (2)

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Sol. $\text{NiCl}_2 \Rightarrow \text{Ni}^{2+} \Rightarrow 3d^8 \Rightarrow \boxed{\downarrow \uparrow \downarrow \uparrow \downarrow \uparrow \uparrow}$

Unpaired electron $n = 2$

$[\text{Ni}(\text{CN})_6]^{4-} \Rightarrow \text{Ni}^{4+} \Rightarrow 3d^6 \Rightarrow t_{2g}^{2,2,2}, e_g^{0,0}$

unpaired electron = 0

difference in unpaired electron = 2

7. What is the major use of dihydrogen (H_2)

- (1) In formation of HNO_3
- (2) In synthesis of ammonia (NH_3)
- (3) In fuel cell for generating electrical energy
- (4) To reduce heavy metal oxides to metal

Sol. The largest single of dihydrogen in the synthesis of ammonia [NCERT page 287]

8. Cu^{2+} salt on reaction with KI forms

- (1) CuI
- (2) Cu_2I_3
- (3) $\text{Cu}(\text{I}_3)_2$
- (4) Does not react

Ans. (1)

Sol. $2\text{Cu}^{2+} + 4\text{KI} \longrightarrow 2\text{CuI}_{(s)} + \text{I}_2 + 4\text{K}^+$

9. Which of the following species does not have magnetic moment (spin only) 1.73 BM

- (1) O_2^-
- (2) O_2^{\oplus}
- (3) CuI
- (4) $[\text{Cu}(\text{NH}_3)_4]\text{Cl}_2$

Ans. (3)

Sol. $\mu = 1.73 \text{ BM}$ It means number of unpaired electron= 1

Species	Unpaired electron
---------	-------------------

O_2^{\oplus}	1
Cu^+	0
Cu^{2+}	1

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- 10.** (i) $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO(s)} + \text{CO}_2\text{(g)}$

(ii) $\text{ZnS} \xrightarrow[\text{Excess air}]{\Delta} \text{ZnO} + \text{SO}_2$

Identify the calcination and roasting reaction from above
(1) Both reaction are roasting

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(4) 1st reaction is roasting and 2nd reaction is calcination

Ans. (3)

- Sol.** (i) Calcination $\Rightarrow \text{CaCO}_3(s) \xrightarrow{\Delta} \text{CaO}(s) + \text{CO}_2(g)$
(ii) Roasting $\Rightarrow \text{ZnS} \xrightarrow[\text{O}_2]{\Delta} \text{ZnO}(s) + \text{SO}_2(g)$

11. For a reaction $\Delta G^\circ = -51.4 \text{ KJ/mol}$ and $\Delta H^\circ = 49.4 \text{ KJ/mol}$ at 300K, then value of ΔS° in J/K is

Ans (336)

$$\text{Sol. } \Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$$

$$\Delta S^\circ = \frac{49.4 + 51.4}{300}$$

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12. In 13th group from the element with electronic configuration $4s^24p^1$ if we move diagonally then the electronic configuration of 5th period element is:

- (1) $5s^2 5p^3$ (2) $4s^2 4p^1$ (3) $4s^2 4p^2$ (4) $5s^2 5p^1$

Ans (4)

		13 th	14 th	15 th
2 nd period	$2s^2p^1$	B	C	N
3 rd period	$3s^23p^1$	Al	Si	P
4 th period	$4s^24p^1$	Ga	Ge	As
5 th period	$5s^25p^1$	In	Sn	Sb

That element is $_{50}\text{Sn} \Rightarrow [\text{Kr}] 4\text{d}^{10} 5\text{s}^2 5\text{p}^2$

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13. Identify the correct hybridisation of



- (1) sp^2 , sp , sp^3 (2) sp , sp^2 , sp^3 (3) sp^3 , sp^2 , sp (4) sp^2 , sp^3 , sp

Ans (1)





Ans. (1)

Sol. Enzymes are highly specific in nature

15. A metal crystallizes in FCC lattice in addition to 50% occupancy of tetrahedral voids, find the effective number of atoms of metal per unit cell.

Ans (8)

Sol. Metal crystallize in fcc unit cell

Effective No. of Atoms = 4 [FCC] + 8 [TV] 1/2

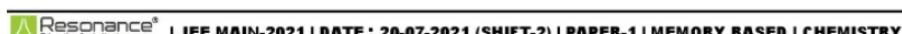
Ans = 8

Initially we take 50 moles of PCl_5 and after 120 minutes final moles of PCl_5 is 10 then the value of rate constant of reaction is $[X] \times 10^{-4}$ minutes, then value of $[Y]$ is:

Ans (133)

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$$\text{Sol. } \text{PCl}_5(\text{g}) \longrightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$$

$t = 0$ 50 moles

$t = 120$ minutes 10 mole

1. (a)

$$K = \frac{1}{4} \ln \left(\frac{2 + v}{2 - v} \right)$$

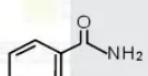
$$= \frac{1}{120} \log\left(\frac{10}{1}\right)$$

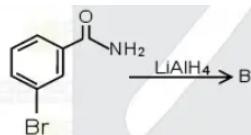
$$= \frac{2.303 \times 0.693}{120} = 0.0133 \text{ minutes}$$

$$= 133 \times 10^{-4} \text{ minutes}$$

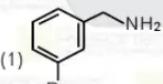
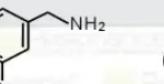
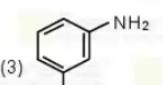
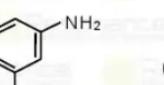
17. Among H_2SO_4 and HNO_3 , which act as acid and base respectively during nitration ?
 (1) H_2SO_4 , HNO_3 (2) HNO_3 , H_2SO_4 (3) HNO_3 , HNO_3 (4) H_2SO_4 , H_2SO_4

Ans. (1)





A and B are respectively:

- | | |
|---|---|
| (1)  | (2)  |
| (3)  | (4)  |

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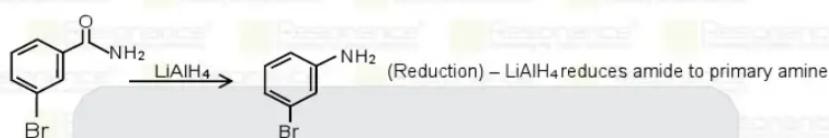
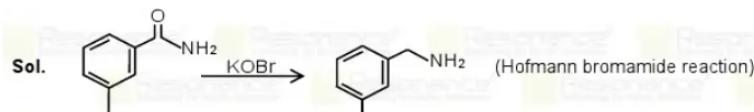
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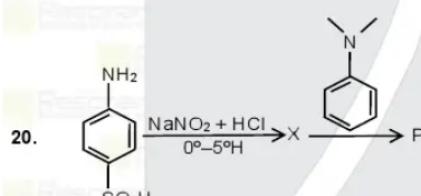
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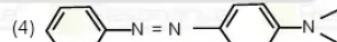
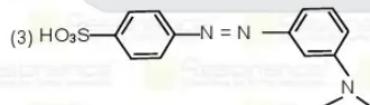
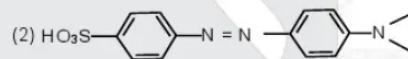
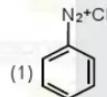
19. Which gas retards photosynthesis?

- (1) CO (2) CO₂ (3) SO₂ (4) NO

Sol. Reason: NO₂ damage the leaves of plants and retard the photosynthesis.



Find product (P) is:



Ans. (2)

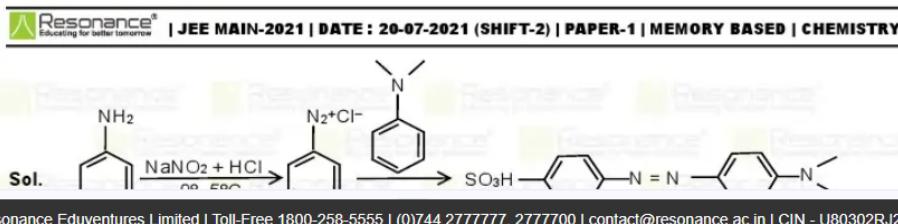
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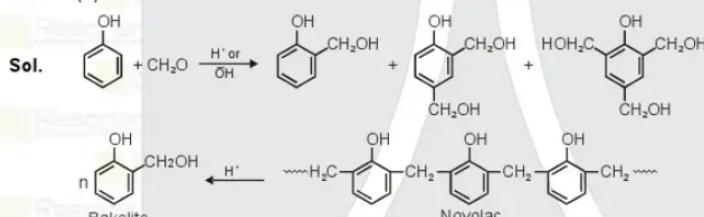


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Diazotisation reaction

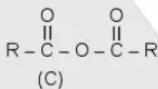
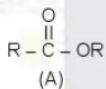
21. Which one is form as intermediate during the formation of Bakelite.
(1) Novalac (2) Buna-S (3) Buna-N (4) Adipic acid

Ans.



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- 22.** Rate of hydrolysis of given compounds ester, acid chloride, acid anhydride is:



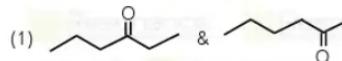
- (1) B > A > C (2) B > C > A (3) A > B > C (4) C > A > B

Ans. (2)

Sol. Rate of hydrolysis is directly proportional to δ positive charge present on carbon of $\text{C}=\text{O}$ group.

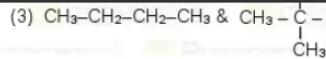
Rate of hydrolysis – Acid chloride > Acid anhydride > ester

- 23.** Which of following compounds are metamers?



- $$(2) \text{CH}_3\text{--CH}_2\text{--OH} \text{ & } \text{CH}_3\text{--O--CH}_2\text{--CH}_3$$

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Ans. (1)

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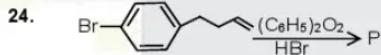
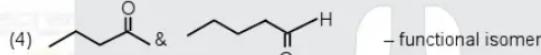
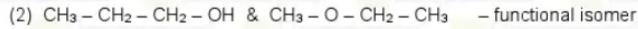
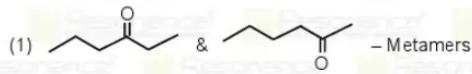
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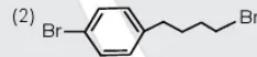
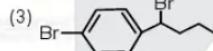
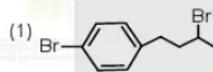
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Sol. Metamers are compounds which have different alkyl groups present along both side of polyvalent functional group.



Product (P) is :



Ans. (2)

Sol. Here addition of HBr in presence of peroxide takes place according to antimarkovnikov rule.

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