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(Main)

PAPER-1 (B.E./B. TECH.)

2021

COMPUTER BASED TEST (CBT) Memory Based Questions & Solutions

Date: 22 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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PART : CHEMISTRY

1. Find total number of electrons in p-orbitals of vanadium ($Z = 23$)

Ans. (12)

Sol. ${}_{23}\text{V} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$

2. Identify the correct sequence of hybridization of following species

NH_4^+ , NO_2^+ , SF_4 , IF_5

(1) sp^3 , sp , sp^3d , sp^3d^2

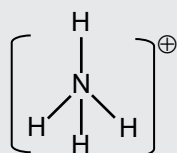
(3) sp^3 , sp , sp^3d , sp^3d

(2) sp , sp^2 , sp^3 , sp^3d

(4) sp^3 , sp^2 , sp^3d , sp^3d^2

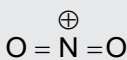
Ans. (1)

Sol. NH_4^+



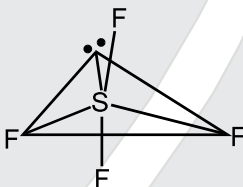
sp^3

NO_2^+



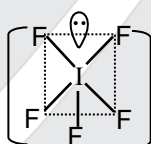
sp

SF_4



sp^3d

IF_5



sp^3d^2

3. Identify the incorrect statement regarding Mendeleev.

(1) He is the writer of chemistry book. i.e., 'principles of chemistry'

(2) Mendeleev proposed the periodic table when structure of atoms were unknown

(3) Atomic number 101 element named after Mendeleev

(4) Mendeleev developed accurate barometer.

Ans. (2)

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4. Identify the correct set which is paramagnetic and coloured.

- (1) Cu^{2+} , Sc^+ , Cr^{3+} (2) Mn^{7+} , Cr^{3+} , Hg^{2+}
 (3) Cu^+ , Sc^{3+} , Co^+ (4) Mn^{7+} , Cu^+ , Cr^{3+}

Ans. (1)

Sol. Ion No. of unpaired e^-

Cu^{2+} 1

Sc^+ 2

Cr^{3+} 3

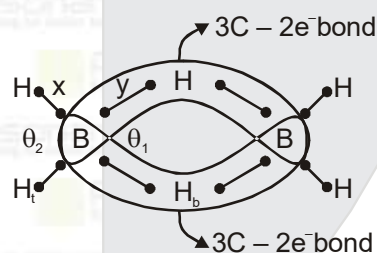
This set is "paramagnetic & coloured"

5. Identify the correct statement regarding diborane (B_2H_6)

- (1) Hybridisation of boron is sp^2 (2) It contain one 3 center- 2 electron bond.
 (3) It is planer molecule (4) NaBH_4 on oxidation with I_2 give B_2H_6

Ans. (4)

Sol. $2\text{NaBH}_4 + \text{I}_2 \xrightarrow{\text{ether}} \text{B}_2\text{H}_6 + 2\text{NaI} + \text{H}_2 \uparrow$



6. K_P for the reaction $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ at 288 k is 47.9, then value of K_C is -
 [Report your answer to nearest integer]

[Given $R = 0.083 \text{ bar lit / mole K}$]

Ans. (2)

Sol. $K_P = K_C (\text{RT})^{\Delta n_g}$

$$47.9 = K_C (0.083 \times 288)^1$$

$$K_C = 2$$

7. How many total number of unpaired electrons are present in $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ and $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$

Ans. (1)

Sol. Complex

(i) $[\text{Co}(\text{NH}_3)_6] \text{Cl}_2 \Rightarrow \text{Co}^{2+} = 3d^7$ unpaired electron = 1

(ii) $[\text{Co}(\text{NH}_3)_6] \text{Cl}_3 \Rightarrow \text{Co}^{3+} = 3d^6$ unpaired electron = 0

Total unpaired electrons = 1

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8. Isotopes of hydrogen which emits low energy β^- particle with half life greater than 12 year is :

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

Sol. Only tritium is radioactive and emits low energy β particles ($t_{1/2}$, 12.33 years)

9. The concentration of glucose ($C_6H_{12}O_6$) in blood is 0.72 gram/lit, the molarity of glucose is $[x] \times 10^{-3}$ M, then value of x is

Ans. (4)

Sol.
$$M = \frac{W_{\text{solute}}}{M_{\text{solute}} \times V_{\text{soln}}(\text{in lit})}$$

$$= \frac{0.72}{180}$$

$$= 0.004 = 4 \times 10^{-3}$$

10. 0.05 M solution of which compound have lowest freezing point

- (1) K_2SO_4 (2) KI (3) $C_6H_{12}O_6$ (4) $Al_2(SO_4)_3$

Ans. (4)

Sol. $\Delta T_f = i K_f m$

Greater the i value lower will be freezing point

11. N_2O_5 dissociate according to 1st order kinetic as $(2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g))$. kinetics initial concentration of N_2O_5 is 2.4×10^{-2} M and concentration of N_2O_5 after 1 hour is 1.6×10^{-2} M, then the rate constant k in min^{-1} for this dissociation is $[x] \times 10^{-5}$ min^{-1} , then x is.

Ans. 346

Sol. $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

Initial 2.4×10^{-2} M

After 1 hour 1.6×10^{-2} M

$$t = \frac{1}{2k} \ln \left(\frac{a}{a-x} \right)$$

$$k = \frac{2.303}{2 \times 60} \log \left(\frac{2.4 \times 10^{-2}}{1.6 \times 10^{-2}} \right)$$

$$k = \frac{2.303}{2 \times 60} \log \left(\frac{3}{2} \right)$$

$$= \frac{2.303}{2 \times 60} \times [0.48 - 0.30]$$

$$= 0.00346$$


$$= 346 \times 10^{-5} \text{ min}^{-1}$$

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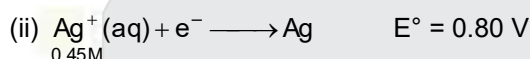
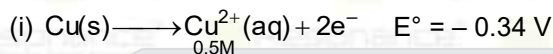
12. Oxygen is maximum soluble in

- (1) Water at 4°C (2) Water at 80°C (3) Polluted water (4) Boiling water

Ans. (1)

Sol. Solubility of oxygen is increase with decrease in temperature.

13. Using the following cell reaction find cell



$$[\text{Given } \log 2.5 = 0.4] \quad \frac{2.303RT}{F} = 0.06$$

Report your answer as $[E_{\text{cell}}] \times 10^{-3}$.

Ans. (448)

Sol. $E^{\circ}_{\text{cell}} = (E^{\circ}_{\text{RP}})_{\text{C}} - (E^{\circ}_{\text{RP}})_{\text{A}}$
 $= 0.80 - 0.34 = 0.46 \text{ V}$

$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.06}{2} \log \frac{[\text{Cu}^{2+}]}{[\text{Ag}^{+}]^2} = 0.46 - \frac{0.06}{2} \log \left\{ \frac{0.5}{(0.45)^2} \right\}$$

$$= 0.46 - \frac{0.06}{2} \log 2.5 = 0.46 - \frac{0.06}{2} \times 2.5$$

$$= 0.46 - 0.012 = 0.448 = 448 \times 10^{-3}$$

14. Match column-I with Column-II

Column-I

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

Column-II

- (i) soluble in organic compound
(ii) outer electronic configuration is $6s^2$
(iii) oxalate is not soluble in aqueous solution
(iv) form strong monobasic compound

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

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

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

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

Ans. (1)

15. Find the sum of magnetic moment (spin only) of following ion Co^+ , Zn^{2+} , V^{5+}

[Report your answer to nearest integer]






Ans. 5

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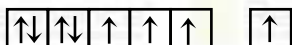
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Sol. ${}_{27}\text{Co}^+ = [{}_{18}\text{Ar}]3d^7 4s^1$



Unpaired electron = 4

${}_{30}\text{Zn}^{2+} = [\text{Ar}]3d^{10}$ unpaired electron = 0

${}_{23}\text{V}^{5+} = [{}_{18}\text{Ar}]3d^0$ unpaired electron = 0

So $\mu = \sqrt{n(n+2)}$ BM

= $\sqrt{24}$ BM

= 4.89 BM

16. Which of the following have strong reducing power

(1) PH_3

(2) BiH_3

(3) AsH_3

(4) SbH_3

Ans. (2)

Sol. NH_3

PH_3

AsH_3

SbH_3

BiH_3

As we move down the group reducing power is increase.

17. When AgNO_3 solution is added to KI, the sol produced is

(1) KI/NO_3^-

(2*) AgI/Ag^+

(3) AgI/I^-

(4) $\text{AgNO}_3/\text{NO}_3^-$

Sol. $\text{AgNO}_3 + \text{KI} \rightarrow \text{AgI} \downarrow + \text{Ag}^+$

18. How much heat is released on (in kJ) of 10 gram graphite

[Given $\Delta H_{\text{combustion}}$ (graphite) = -2.48 kJ/mol]

[Report your answer to nearest integer]

Ans. 2

Sol. $\text{C}(\text{graphite}) + \text{O}_2 \rightarrow \text{CO}_2(\text{g}) \Delta H = -2.48$ kJ mole $\frac{10}{12}$ mole






Total heat released = $2.48 \times \frac{10}{12} = 1.90$ kJ

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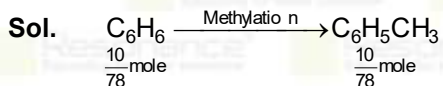
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19. 10 gram Benzene (GMM = 78) on methylation give 9.2 gram of Toluene (GMM = 92), then percentage yield of process is :

Ans. 78.00



$$(W_{\text{theoretical}}) = \frac{10}{78} \times 92$$

$$\% \text{ yield} = \frac{W_{\text{actual}}}{W_{\text{theoretical}}} \times 100$$

$$= \left[\frac{9.2}{10 \times 92} \times 78 \right] \times 100 = 78\%$$

20. The total number of isomers of square planar complex [MCl(SCN)(NO₂)] is

- (1) 12 (2) 6 (3) 8 (4) 4

Ans. (1)

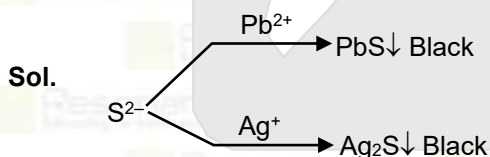
Sol. SCN/NO₂ – 3 arrangements
 NCS/NO₂ – 3 arrangements
 SCN/ONO – 3 arrangements
 NCS/ONO – 3 arrangements

Total number of isomers = 12

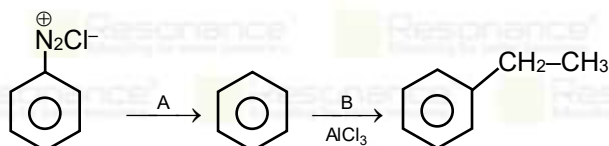
21. Consider sulphide ion [S²⁻ ion] as a soft base. Which of the following ion will form sulphide [36 T]

- (1) Pb²⁺, Ag⁺ (2) Ag⁺, Mg²⁺ (3) Al³⁺, Ag⁺ (4) Al³⁺, Mg²⁺

Ans. (3)



22. In the following sequence of reactions identify A & B respectively : [OC, Aromatic, XII, M]



- (1) H₃PO₂ CH₃-CH₂-Cl (2) H₃PO₂ CH₃-CH₂-OH
 (3) CH₃-CH₂-OH H₃PO₂ (4) CH₃-CH₂-Cl H₃PO₂

Ans. (1)

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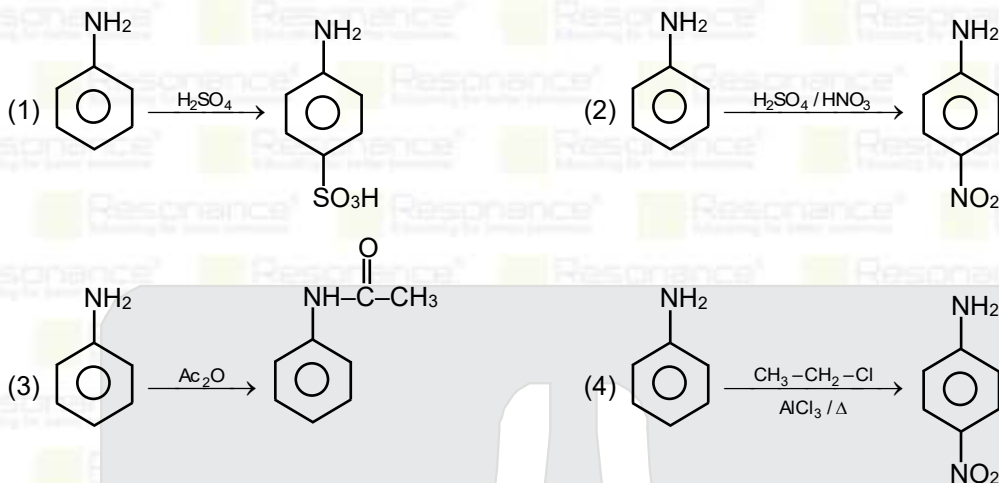
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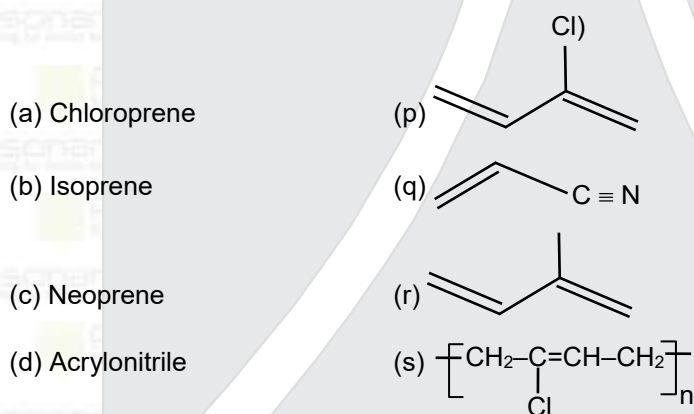
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25. Which of the following reaction is not possible :



Sol. Friedel-Craft alkylation is not possible in aniline due to formation of highly deactivated cationic salt.

26. Match the following :



Ans. (1*) (a) → (p), (b) → (r), (c) → (s), (d) → (q) (2) (a) → (r), (b) → (s), (c) → (p), (d) → (q)
 (3) (a) → (r), (b) → (p), (c) → (q), (d) → (s) (4) (a) → (q), (b) → (r), (c) → (p), (d) → (s)

Sol. NCERT

27. Which of the following does not show stereoisomerism








Ans. (4)

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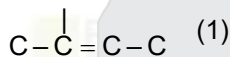
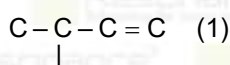
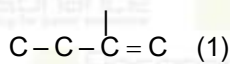
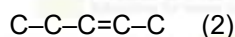
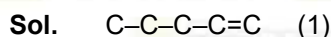
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28. Total acyclic number of structures including geometrical of pentene is

Ans. 6



29. Thiamin & pyridoxine vitamin are respectively :

(1) B₁ & B₆

(2) B₂ & E

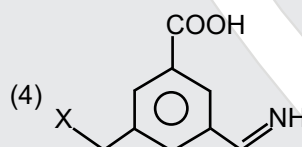
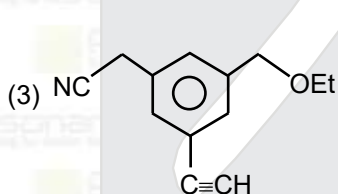
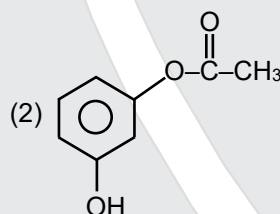
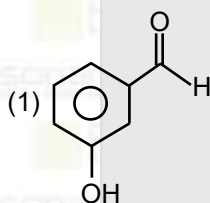
(3) B₁ & E

(4) E₁ & B₆

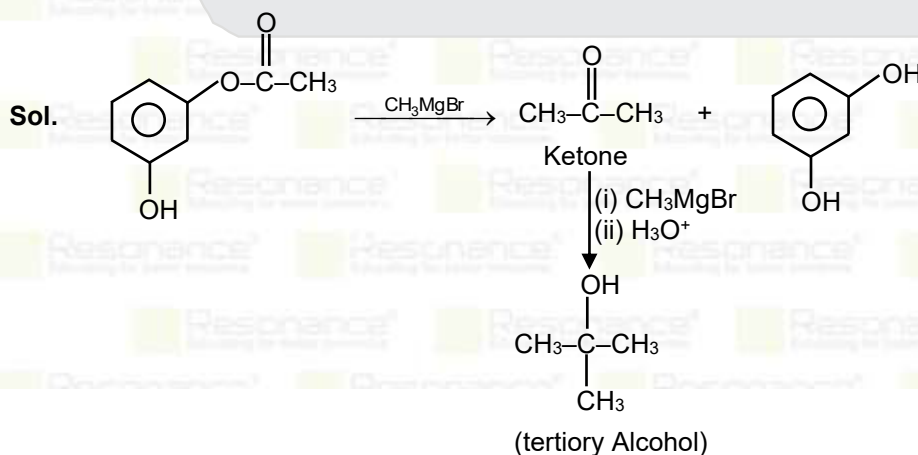
Ans. (1)

Sol. NCERT

30. Which of the following give tertiary alcohol with excess Grignard reagent (CH₃MgBr)



Ans. (2)



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