



# JEE MAIN 2016

ONLINE EXAMINATION

DATE : 09-04-2016

SUBJECT : CHEMISTRY

TEST PAPER  
WITH SOLUTIONS & ANSWER KEY

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1. The artificial sweetener that has the highest sweetness value in comparison to cane sugar is :  
(1) Saccharin (2) Sucralose (3) Alitame (4) Aspartane

Ans. (3)

Sol. Alitame is 2000 times sweeter than sucrose.

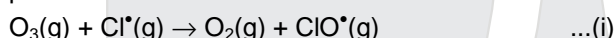
2. The non-metal that does not exhibit positive oxidation state is :

(1) Fluorine (2) Oxygen (3) Chlorine (4) Iodine

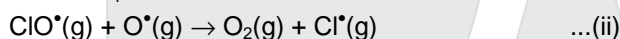
Ans. (1)

Sol. Fluorine is the most electronegative element in periodic table hence it shows -1 oxidation state in all its compounds.

3. The reaction of ozone with oxygen atoms in the presence of chlorine atoms can occur by a two step process show below:



$$k_i = 5.2 \times 10^9 \text{ L mol}^{-1} \text{ s}^{-1}$$



$$k_{ii} = 2.6 \times 10^{10} \text{ L mol}^{-1} \text{ s}^{-1}$$

The closest rate constant for the overall reaction  $\text{O}_3(\text{g}) + \text{O}^*(\text{g}) \rightarrow 2\text{O}_2(\text{g})$  is:

(1)  $1.4 \times 10^{20} \text{ L mol}^{-1} \text{ s}^{-1}$

(2)  $5.2 \times 10^9 \text{ L mol}^{-1} \text{ s}^{-1}$

(3)  $3.1 \times 10^{10} \text{ L mol}^{-1} \text{ s}^{-1}$

(4)  $2.6 \times 10^{10} \text{ L mol}^{-1} \text{ s}^{-1}$

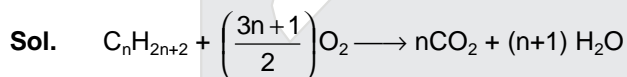
Ans. (2)

Sol. The rate constant of overall reaction depends slowest step. Hence equation(i) is slowest step. Option(2) is correct.

4. 5L of an alkane requires 25 L of oxygen for its complete combustion. If all volumes are measured at constant temperature and pressure, the alkane is ;

(1) Butane (2) Isobutane (3) Ethane (4) Propane

Ans. (4)



5 L            25 L

Since volumes are measured at constant T & P

So, Volume  $\propto$  mole

$$\therefore n_{\text{alkane}} = \left(\frac{2}{3n+1}\right) \times n_{\text{O}_2}$$

$$5 = \frac{2}{3n+1} \times 25$$






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∴  $n = 3$

∴ Alkane is propane ( $C_3H_8$ ).

5. Match the items in Column I with its main use listed in Column II:

Column I	Column II
(A) Silica gel	(i) Transistor
(B) Silicon	(ii) Ion-exchanger
(C) Silicone	(iii) Drying agent
(D) Silicate	(iv) Sealant

(1) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(2) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(3) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

(4) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

Ans. (1)

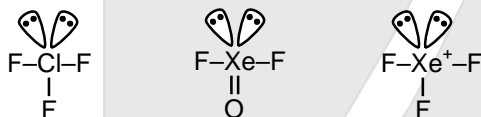
Sol. Based on theoretical fact.

6. The group of molecules having identical shape is :

(1)  $PCl_5$ ,  $IF_5$ ,  $XeO_2F_2$     (2)  $BF_3$ ,  $PCl_3$ ,  $XeO_3$     (3)  $ClF_3$ ,  $XeOF_2$ ,  $XeF_3^+$     (4)  $SF_4$ ,  $XeF_4$ ,  $CCl_4$

Ans. (3)

Sol.  $ClF_3$ ,  $XeOF_2$  &  $XeF_3^+$  are  $sp^3d$  hybridized with 2 lone pair e's, hence all have (T-shape) identical shape.

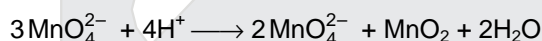


7. Which one of the following species is stable in aqueous solution?

(1)  $MnO_4^{2-}$     (2)  $MnO_4^{3-}$     (3)  $Cu^+$     (4)  $Cr^{2+}$

Ans. (1)

Sol. (1)  $MnO_4^{2-}$  disproportionates in neutral or acidic solution.



(3) Many  $Cu^+$  compounds are unstable in aqueous solution and undergo disproportionation as follows  
 $2Cu^+ \longrightarrow Cu^{2+} + Cu$

8. For the reaction,



The equilibrium constant for the reaction at 298 K is:

(1) 1    (2) 10    (3)  $1.0 \times 10^{-10}$     (4)  $1.0 \times 10^{10}$

Ans. (1)

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**Sol.**  $\Delta G^{\circ} = \Delta H^{\circ} - T.\Delta S^{\circ}$   
 $= -29.8 + 298 \times (0.1)$   
 $= -29.8 + 29.8$

$\therefore \Delta G^{\circ} = 0$

apply relation between  $\Delta G^{\circ}$  &  $K_{eq}$

$\Delta G^{\circ} = -RT \ln K_{eq}$

$\therefore K_{eq} = 1$

9. **Assertion** : Rayon is a semisynthetic polymer whose properties are better than natural cotton.

**Reason** : Mechanical and aesthetic properties of cellulose can be improved by acetylation.

- (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion.  
 (2) Both assertion and reason are incorrect.  
 (3) Assertion is incorrect statement, but the reason is correct.  
 (4) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion.

**Ans.** (1)

**Sol.** Rayon is prepared by acetylation of cellulose.

10. The hydrocarbon with seven carbon atoms containing a neopentyl and a vinyl group is :

- (1) 4,4-dimethylpentene (2) 2,2-dimethyl-4-pentene  
 (3) Isopropyl-2-butene (4) 2,2-dimethyl-3-pentene

**Ans.** (1)

**Sol.**  $\left[ \begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}=\text{CH}_2 \\ | \quad | \quad | \\ 5 \quad 4 \quad 3 \quad 2 \quad 1 \\ \text{CH}_3 \end{array} \right]$  has seven carbon atoms containing a neopentyl and a vinyl group.

11. The gas evolved on heating  $\text{CH}_3\text{MgBr}$  in methanol is:

- (1) Propane (2) Ethane (3) HBr (4) Methane

**Ans.** (4)

**Sol.**  $\text{CH}_3\text{MgBr} + \text{CH}_3-\text{OH} \longrightarrow (\text{CH}_3\text{O})\text{MgBr} + \text{CH}_4 \uparrow$  gas.






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12. Identify the correct trend given below:

(Atomic No.: Ti = 22, Cr = 24 and Mo = 42)

(1)  $\Delta_o$  of  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} < [\text{Mo}(\text{H}_2\text{O})_6]^{2+}$  and  $\Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+} < [\text{Ti}(\text{H}_2\text{O})_6]^{2+}$

(2)  $\Delta_o$  of  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} > [\text{Mo}(\text{H}_2\text{O})_6]^{2+}$  and  $\Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+} > [\text{Ti}(\text{H}_2\text{O})_6]^{2+}$

(3)  $\Delta_o$  of  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} > [\text{Mo}(\text{H}_2\text{O})_6]^{2+}$  and  $\Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+} < [\text{Ti}(\text{H}_2\text{O})_6]^{2+}$

(4)  $\Delta_o$  of  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} < [\text{Mo}(\text{H}_2\text{O})_6]^{2+}$  and  $\Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+} > [\text{Ti}(\text{H}_2\text{O})_6]^{2+}$

Ans. (1)

Sol.  $\Delta_o \propto \text{CFSE}$  (Crystal field stabilization energy)

$\Delta_o$  of  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} < \Delta_o$  of  $[\text{Mo}(\text{H}_2\text{O})_6]^{2+}$

Because here  $\Delta_o$  depends on  $Z_{\text{eff}}$  &  $Z_{\text{eff}}$  of 4d series is more than 3d series.

But  $\Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+} < \Delta_o$  of  $[\text{Ti}(\text{H}_2\text{O})_6]^{2+}$

13. The most appropriate method of making egg-albumin sol is:

(1) Keep the egg in boiling water for 10 minutes. After removing the shell, transfer the yellow part of the content to 100 mL of 5% w/V saline solution and homogenize with a mechanical shaker.

(2) Break an egg carefully and transfer the transparent part of the content to 100 mL of 5% w/V saline solution and stir well.

(3) Keep the egg in boiling water for 10 minutes. After removing the shell, transfer the white part of the content to 100 mL of 5% w/V saline solution and homogenize with a mechanical shaker.

(4) Break an egg carefully and transfer only the yellow part of the content to 100 mL of 5% w/V saline solution and stir well.

Ans. (2)

Sol. Only the transparent part of egg has albumin.

14. Which one of the following complexes will consume more equivalents of aqueous solution of  $\text{Ag}(\text{NO}_3)$  ?

(1)  $\text{Na}_3[\text{CrCl}_6]$

(2)  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$

(3)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$

(4)  $\text{Na}_2[\text{CrCl}_5(\text{H}_2\text{O})]$

Ans. (3)

Sol. Complex  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  will consume more equivalents of aqueous solution of  $\text{Ag}(\text{NO}_3)$ .






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15. At very high pressures, the compressibility factor of one mole of a gas is given by :

- (1)  $1 + \frac{pb}{RT}$                       (2)  $\frac{pb}{RT}$                       (3)  $1 - \frac{b}{VRT}$                       (4)  $1 - \frac{pb}{RT}$

Ans. (1)

Sol. According to Vander waal's equation for one mole of gas

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT$$

at high pressure  $\frac{a}{V^2}$  can be neglected with respect to P,

$$\therefore P + \frac{a}{V^2} \approx P$$

$$P(V - b) = RT$$

$$PV - Pb = RT$$

$$PV = RT + Pb$$

divided on RT on both side,

$$Z = 1 + \frac{Pb}{RT}$$

16. A reaction at 1 bar is non-spontaneous at low temperature but becomes spontaneous at high temperature.

Identify the correct statement about the reaction among the following:

- (1) Both  $\Delta H$  and  $\Delta S$  are positive.                      (2)  $\Delta H$  is negative while  $\Delta S$  is positive.  
(3)  $\Delta H$  is positive while  $\Delta S$  is negative.                      (4) Both  $\Delta H$  and  $\Delta S$  are negative.

Ans. (1)

Sol.  $\Delta G = \Delta H - T.\Delta S$

If  $\Delta H$  &  $\Delta S$  are both positive, then  $\Delta G$  may be negative at high temperature hence reaction becomes spontaneous at high temperature.

17. Which intermolecular force is most responsible in allowing xenon gas to liquefy?

- (1) Instantaneous dipole-induced dipole                      (2) Ionic  
(3) Ion-dipole                      (4) Dipole-dipole

Ans. (1)

Sol. Instantaneous dipole-induced dipole forces are most responsible in allowing xenon gas to liquify.






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18. Identify the incorrect statement regarding heavy water:

- (1) It reacts with  $\text{CaC}_2$  to produce  $\text{C}_2\text{D}_2$  and  $\text{Ca}(\text{OD})_2$ .
- (2) It is used as a coolant in nuclear reactors.
- (3) It reacts with  $\text{Al}_4\text{C}_3$  to produce  $\text{CD}_4$  and  $\text{Al}(\text{OD})_3$ .
- (4) It reacts with  $\text{SO}_3$  to form deuterated sulphuric acid ( $\text{D}_2\text{SO}_4$ ).

Ans. (2)

Sol. Heavy water ( $\text{D}_2\text{O}$ ) acts as moderator used to slow down the speed of neutrons in nuclear reactor, hence option (2) is incorrect.

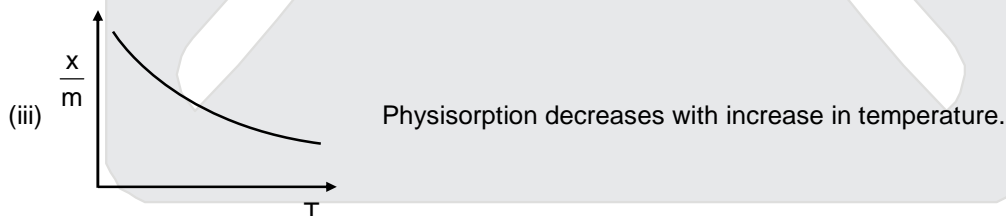
19. A particular adsorption process has the following characteristics: (i) It arises due to vander Waals forces and (ii) it is reversible. Identify the correct statement that describes the above adsorption process:

- (1) Enthalpy of adsorption is greater than  $100 \text{ kJ mol}^{-1}$ .
- (2) Adsorption is monolayer.
- (3) Adsorption increases with increase in temperature.
- (4) Energy of activation is low.

Ans. (4)

Sol. Adsorption arises due to Vander waal forces & reversible, hence it should be physisorption (physical adsorption).

- (i) Enthalpy of physisorption is low ( $20 - 40 \text{ kJ/mol}$ )
- (ii) In physisorption multimolecular layer form.



- (iv) Physisorption required number activation energy.

Hence answer is (4)





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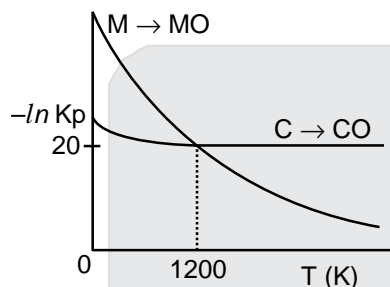
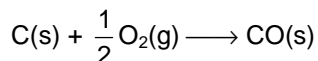
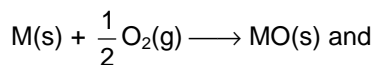
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20. The plot shows the variation of  $-\ln K_p$  versus temperature for the two reactions.

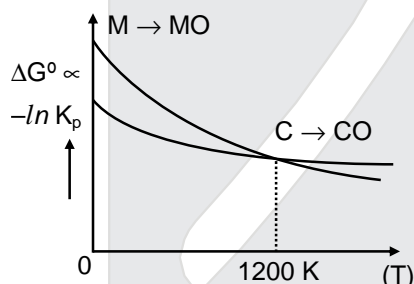


Identify the correct statement:

- (1) At  $T > 1200$  K, carbon will reduce  $MO(s)$  to  $M(s)$ .
- (2) At  $T < 1200$  K, oxidation of carbon is unfavourable.
- (3) Oxidation of carbon is favourable at all temperatures.
- (4) At  $T < 1200$  K, the reaction  $MO(s) + C(s) \rightarrow M(s) + CO(g)$  is spontaneous.

Ans. (4)

Sol. According to Ellingham diagram, as given



At  $T < 1200$ , carbon will reduce  $MO(s)$  to  $M(s)$  hence, chemical reaction  $C(s) + MO(s) \longrightarrow M(s) + CO(g)$  is spontaneous.

21. BOD stands for:

- (1) Biochemical Oxygen Demand
- (2) Biochemical Oxidation Demand
- (3) Biological Oxygen Demand
- (4) Bacterial Oxidation Demand

Ans. (1)

Sol. BOD stands for Biochemical oxygen demand.






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22. What will occur if a block of copper metal is dropped into a beaker containing a solution of 1M ZnSO<sub>4</sub>?
- (1) The copper metal will dissolve and zinc metal will be deposited.
  - (2) The copper metal will dissolve with evolution of oxygen gas.
  - (3) The copper metal will dissolve with evolution of hydrogen gas.
  - (4) No reaction will occur.

Ans. (4)

Sol. If a block of copper metal is dropped into a beaker containing solution of 1 M ZnSO<sub>4</sub>, no reaction will occur because

$$E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76 \text{ V}$$

$$E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = +0.34 \text{ V}$$

Hence Cu can't displace Zn from ZnSO<sub>4</sub> solution.

23. The test to distinguish primary, secondary and tertiary amine is:

- |                          |  |
|--------------------------|--|
| (1) Mustard oil test     | (2) C <sub>6</sub> H <sub>5</sub> SO <sub>2</sub> Cl |
| (3) Sandmeyer's reaction | (4) Carbylamine reaction                             |

Ans. (2)

Sol. Benzene sulphonyl chloride (C<sub>6</sub>H<sub>5</sub>SO<sub>2</sub>Cl) is used to distinguish primary, secondary and tertiary amine.

24. The total number of orbitals associated with the principal quantum number 5 is:

- |       |        |        |        |
|-------|--------|--------|--------|
| (1) 5 | (2) 20 | (3) 25 | (4) 10 |
|-------|--------|--------|--------|

Ans. (3)

Sol.  $n = 5$

Possible subshell are

⇒ 5s, 5p, 5d, 5f, 5g

∴ Total number of orbital = 1 + 3 + 5 + 7 + 9 = 25

25. The correct order of the solubility of alkaline-earth metal sulphates in water is:

- |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| (1) Mg < Sr < Ca < Ba | (2) Mg > Ca > Sr > Ba | (3) Mg > Sr > Ca > Ba | (4) Mg < Ca < Sr < Ba |
|-----------------------|-----------------------|-----------------------|-----------------------|

Ans. (2)

Sol. Solubility of sulphates of alkaline earth metal decreases down the group. Hence correct order of solubility is Mg > Ca > Sr > Ba






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26. An organic compound contains C, H and S. The minimum molecular weight of the compound containing 8% sulphur is:

(atomic weight of S = 32 amu)

- (1) 300 g mol<sup>-1</sup>      (2) 400 g mol<sup>-1</sup>      (3) 200 g mol<sup>-1</sup>      (4) 600 g mol<sup>-1</sup>

Ans. (2)

Sol. 8 g sulphur present in = 100 g of organic compound.

$$\therefore 32 \text{ g sulphur present in} = \frac{100}{8} \times 32 = 400 \text{ g of organic compound.}$$

Hence, minimum molecular weight of compound = 400 g/mol

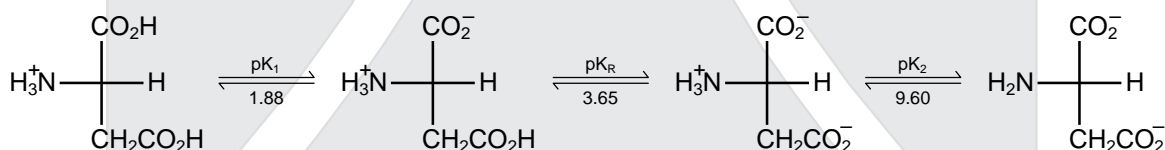
27. Bouveault-Blanc reduction reaction involves:

- (1) Reduction of an anhydride with LiAlH<sub>4</sub>.  
 (2) Reduction of an ester with Na/C<sub>2</sub>H<sub>5</sub>OH.  
 (3) Reduction of a carbonyl compound with Na/Hg and HCl.  
 (4) Reduction of an acyl halide with H<sub>2</sub>/Pd.

Ans. (2)

Sol. Reduction using Na in ethylalcohol is called Bouveault-Blanc reduction.

28. Consider the following sequence for aspartic acid:



The pI (isoelectric point) of aspartic acid is:

- (1) 5.74      (2) 3.65      (3) 2.77      (4) 1.88

Ans. (3)

Sol. In given reaction sequence

$$\begin{aligned} \text{PI} &= \frac{\text{p}K_1 + \text{p}K_R}{2} \\ &= \frac{1.88 + 3.65}{2} = 2.77 \end{aligned}$$

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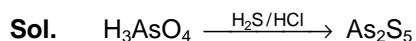
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29. The amount of arsenic pentasulphide that can be obtained when 35.5 g arsenic acid is treated with excess  $H_2S$  in the presence of conc.  $HCl$  (assuming 100% conversion)

- (1) 0.25 mol                      (2) 0.125 mol                      (3) 0.333 mol                      (4) 0.50 mol

Ans. (2)



Assuming 100% conversion of As, apply POAC rule for 'As' atom

$$1 \times n_{H_3AsO_4} = 2 \times n_{As_2O_5}$$

$$\frac{35.5}{142} = 2 \times n_{As_2O_5}$$

$$\therefore n_{As_2O_5} = 0.125 \text{ mol}$$

30. The solubility of  $N_2$  in water at 300 K and 500 torr partial pressure is  $0.01 \text{ g L}^{-1}$ . The solubility (in  $\text{g L}^{-1}$ ) at 750 torr partial pressure is :

- (1) 0.02                      (2) 0.015                      (3) 0.0075                      (4) 0.005

Ans. (2)

Sol. According to Henry law

$$\frac{P_1}{P_2} = \frac{S_1}{S_2} \quad \therefore S_1 \text{ \& } S_2 \text{ are solubility of gas (g/L)}$$

$$\frac{500}{750} = \frac{0.01}{S_2}$$

$$\therefore S_2 = \frac{750 \times 0.01}{500} = 0.015 \text{ g/L}$$


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