



**Solution:**

Nitrophenol is more acidic than phenol thus, [A] and [C] are less acidic than phenol.

(11) The coordination number of Pt in the complex ion  $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$  is

[A] 3

[B] 4

[C] 5

[D] 6

(12) 'Lock-key' fit theory is for

[A] homogeneous catalysis

[B] heterogeneous catalysis

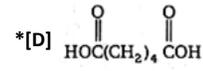
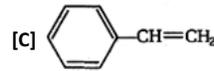
[C] enzyme action

[D] None of these

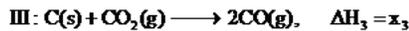
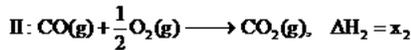
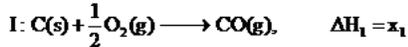
(13) Head-to-tail addition is not preferred in

[A]  $\text{CH}_2=\text{CHCl}$

[B]  $\text{CH}_2=\text{CHCN}$



(14) Consider the following reactions,



Select the correct statements.

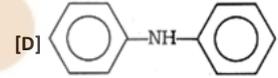
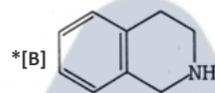
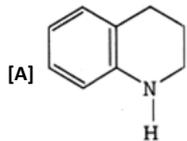
[A] Heat of formation of  $\text{CO}_2$  is  $(x_1 + x_2)$

[B] Heat of combustion of C is  $(x_1 + x_2)$

[C]  $\Delta H_3 = \Delta H_1 - \Delta H_2$

[D] All of the above are correct statements

(15) Which is maximum basic in nature?



(16) Chlorine dioxide

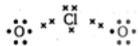
[A] is paramagnetic in nature

[B] has odd electron bond

[C] is stable

[D] has all the above properties true

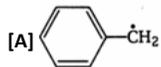
**Solution:**  $\text{ClO}_2$  has following structure



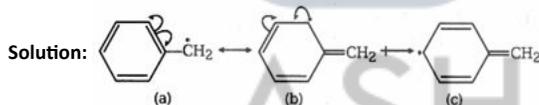
Each Cl-O bond is formed by three electrons thus odd-electron bond. There are resonance structures due to 3-electron bonds and thus stable.

There is one electron unpaired on Cl-atom thus paramagnetic in nature.

(17) Benzyl radical can be



[D] All of these



(18) Biochemical reactions take place spontaneously

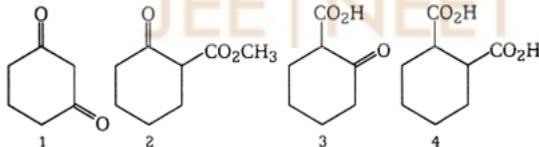
[A] at pH 7 and at 298 K

[B] at pH 7 and at 310 K

[C] at pH 0 and at 310 K

[D] at pH 4 and at 298 K

(19) Which of the following compounds will undergo decarboxylation on heating?



[A] 2 and 3

[B] 3 and 4

[C] 3 only

[D] 1 and 4

(20) The edge length of the NaCl unit cell is ... if radius of  $\text{Na}^+$  is 97 pm and radius of  $\text{Cl}^-$  is 181 pm.

[A] 556 pm

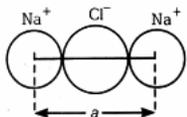
[B] 278 pm

[C] 139 pm

[D] 120 pm

**Solution:**

$$a = 2r_{\text{Na}^+} + 2r_{\text{Cl}^-}$$



$$= 2(97 + 181) = 556 \text{ pm}$$

(21) Heat of combustion of C(s),  $\text{H}_2(\text{g})$  and  $\text{CH}_4(\text{g})$  are  $-x_1$ ,  $-x_2$  and  $-x_3$ . Hence, heat of formation of  $\text{CH}_4(\text{g})$  is

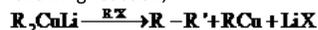
[A]  $-x_1 - x_2 + x_3$

[B]  $-x_1 - 2x_2 - x_3$

[C]  $-x_1 - x_2 + 2x_3$

[D]  $-x_1 - 2x_2 + x_3$

(22) In the following reaction,



Nature of R and R' should be

[A] any alkyl

[B] any alkyl

\*[C] 1° alkyl

[D] 2° alkyl

**Solution:** The synthesis is called Corey-Hoes synthesis and for good yield of R-R'. R'X should be 1° alkyl halide (also methyl) 2° alkyl halide cyclo alkyl halide

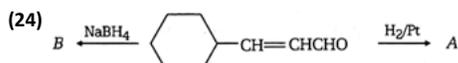
(23) Out of maltose (I), cellobiose (II), sucrose (III) and lactose (IV), reducing sugars are

[A] I, II and III

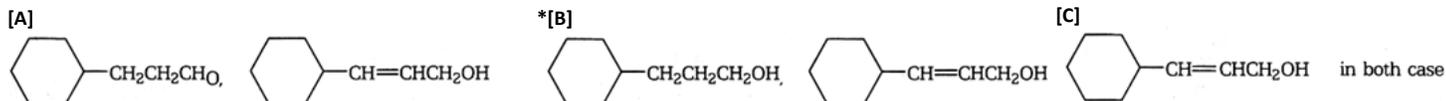
\*[B] I, II and IV

[C] II, III, IV

[D] All of these



A and B are respectively



(25) The van der Waals' constants (a and b) of two gases A and B are

$a/dm^6 atm mol^{-2}$	$6/dm^3 mol^{-1}$
A: 1.360	0.318
B: 3.592	0.0426

The critical parameters  $p_c$ ,  $V_c$  and  $T_c$  are related as (1)  $p_c(A) < p_c(B)$  (2)  $V_c(A) < V_c(B)$  (3)  $T_c(A) < T_c(B)$  Select the correct answer using the codes given below,

[A] 1 alone

[B] 2 and 3

[C] 1 and 2

\*[D] 1 and 3

**Solution:**

	Gas A	Gas B
$p_c = \frac{a}{27b^2} p_c(A) = 0.498 p_c(B) = 73.3$		
$T_c = \frac{8a}{27Rb} T_c(A) = 15.43 T_c(B) = 84.7$		
$V_c = 3b$	$V_c(A) = 0.954$	$V_c(B) = 0.1278$

Thus,  $p_c(A) < p_c(B)$        $T_c(A) < T_c(B)$        $V_c(A) > V_c(B)$

(26) If a chemical reaction is carried out in a fuel cell, the maximum amount of useful work that can be obtained from the cell is

\*[A]  $\Delta G$

[B]  $\Delta H$

[C]  $\frac{\Delta G}{\Delta H}$

[D]  $\Delta S$

(27) Which of the following kills the organisms in the body (bactericidal drug)?

[A] Penicillin

[B] Ofloxacin

\*[C] Both a and b

[D] None of these

(28) ZSM-5 is one of the zeolite with formula

\*[A]  $H_x[(AlO_2)_x \cdot (SiO_2)_{96-x}] \cdot 16H_2O$

[B]  $Na_{56}[(AlO_2)_{56} \cdot (SiO_2)_{36}] \cdot 250H_2O$

[C]  $Na_2Ca(AlO_2)_2(SiO_2)_4 \cdot 6H_2O$

[D] None of the above is correct

(29) One of the following ions has a trigonal planar shape

[A]  $SO_3^{2-}$

[B]  $PO_4^{3-}$

[C]  $CN^-$

\*[D]  $CO_3^{2-}$

**Solution:** Ion with  $sp^2$  hybridisation has trigonal planar structure

(30) An aqueous solution has molality 11.11. Hence, mole fraction of solute in the solution is

\*[A] 0.167

[B] 0.833

[C] 0.40

[D] 0.60

**Solution:**

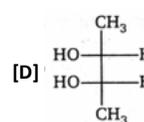
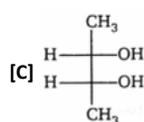
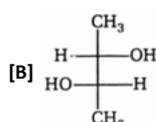
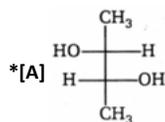
$$\text{Molality} = 11.11 = \frac{\text{moles of solute}}{\text{kg of solvent}}$$

If solute = 11.11 mol

$$\text{kg of solvent} = 1 = 1000 \text{ g} = \frac{1000}{18} \text{ mol} = 55.55 \text{ mol}$$

$$\therefore \text{mole fraction of solute} = \frac{11.11}{11.11 + 55.55} = 0.167$$

(31) (2R, 3R)-2,3-butanediol is



(32)  $2H_2 + O_2 \rightarrow 2H_2O$

2 g  $H_2$  and 1 g  $O_2$  react to form  $H_2O$

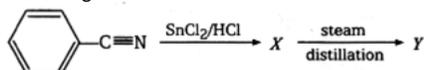
[A] 3.0 g

\*[B] 1.125 g

[C] 4.5 g

[D] 2.50 g

(33) Y in the following reaction is



[A] benzamide

[B] benzophenone

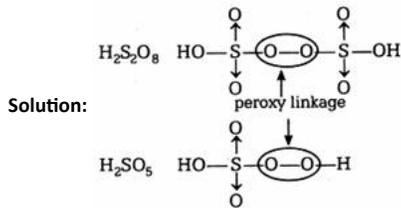
[C] benzoic acid

\*[D] benzaldehyde

**Solution:** Stephen method

(34)  $\text{H}_2\text{S}_2\text{O}_8$  and  $\text{H}_2\text{SO}_5$  both have +6 oxidation state of sulphur. It is due to

- \*[A] presence of peroxy group      [B] presence of superoxo group      [C] presence of neutral  $\text{O}_2$       [D] presence of ozone



(35) "10 volume"  $\text{H}_2\text{O}_2$  means 1 mL  $\text{H}_2\text{O}_2$  gives 10 mL  $\text{O}_2$  at NTP 1g  $\text{H}_2\text{O}_2$  gives 10 mL  $\text{O}_2$  at NTP

- \*[A] 1 mol  $\text{H}_2\text{O}_2$  gives      [B] 10 mL  $\text{O}_2$  at NTP      [C] None of the      [D] above is correct

(36) Extraction of aluminium from aluminium oxide ( $\text{Al}_2\text{O}_3$ ) is best done by

- \*[A] electrolytic reduction of  $\text{Al}_2\text{O}_3$       [B] reduction of  $\text{Al}_2\text{O}_3$  with carbon      [C] reduction of  $\text{Al}_2\text{O}_3$  with sodium      [D] reduction of  $\text{Al}_2\text{O}_3$  with CO

(37) Frenkel defect is the

- [A] Schottky defect      [B] interstitial defect      \* [C] combination of and      [D] None of the above

(38) Which does not represent isobar given by Charles' law?



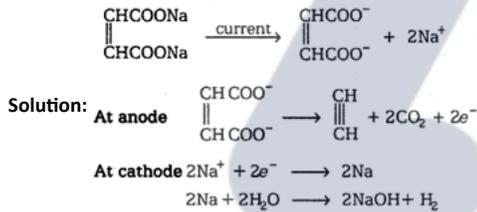
(39) In the absence of Aufbau rule, K(19) would be placed in

- [A] s-block      [B] p-block      \* [C] d-block      [D] f-block

Solution: K(19) has EC (ignoring Aufbau rule)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$  3d is filled in the absence of Aufbau rule). Thus, d-block element.

(40) Which salt can be converted into alkyne by Kolbe's method?

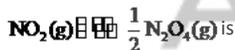
- [A] Sodium acetate      [B] Sodium succinate      \* [C] Sodium maleate      [D] Sodium formate



(41) Stability of nitrides of IIA group elements is in order

- \* [A]  $\text{Ca}_3\text{N}_2 < \text{Mg}_3\text{N}_2 < \text{Be}_3\text{N}_2$       [B]  $\text{Be}_3\text{N}_2 < \text{Mg}_3\text{N}_2 < \text{Ca}_3\text{N}_2$       [C]  $\text{Ca}_3\text{N}_2 < \text{Be}_3\text{N}_2 < \text{Mg}_3\text{N}_2$       [D]  $\text{Mg}_3\text{N}_2 < \text{Be}_3\text{N}_2 < \text{Ca}_3\text{N}_2$

(42) For the reaction,  $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ ,  $K_c$  is  $6.10 \times 10^{-3}$  at  $25^\circ\text{C}$ . Hence,  $K_c$  for the equilibrium reaction



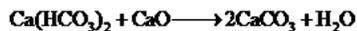
- [A]  $1.64 \times 10^2$       [B] 81.97      [C] 3.14      \* [D] 12.80

(43) Temporary hardness and permanent hardness in water can be removed respectively by the .addition of

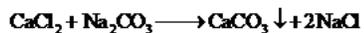
- [A] CaO      \* [B] CaO      [C]  $\text{Na}_2\text{CO}_3$       [D]  $\text{NaHCO}_3$

Solution:

Temporary hardness is due to dissolved  $\text{HCO}_3^-$  of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$



Permanent hardness is due to dissolved  $\text{Cl}^-$  and  $\text{SO}_4^{2-}$  of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$



(44) Which of the following will have maximum electron affinity?

- [A]  $1s^2 2s^2 2p^5$       [B]  $1s^2 2s^2 2p^6$       \* [C]  $1s^2 2s^2 2p^6 3s^2 3p^5$       [D]  $1s^2 2s^2 2p^6 3s^2 3p^6$

Solution: [A] - F [B] - Ne zero (EA) [C] - Cl [D] - Ar zero (EA) [C] Cl > [A] F due to empty d-orbital in Cl

(45) Thermosetting polymers are except

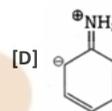
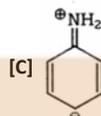
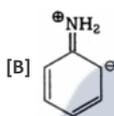
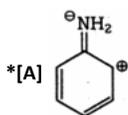
- [A] bakelite      \* [B] PET      [C] epoxy resins      [D] melmac

(46) Bell-metal is an alloy of

- [A] Cu + Pb      \* [B] Cu + Sn      [C] Cu + Zn      [D] Cu + N

- (47) Global warming is called  
 [A] photochemical smog      \* [B] green-house effect      [C] acid rain      [D] respiration
- (48)  $d\pi - p\pi$  bonding is shown in  
 [A]  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{N}^{3-}$ ,  $\text{CN}^-$       \* [B]  $\text{P}_2\text{O}_3$ ,  $\text{P}_2\text{O}_5$ ,  $\text{PO}_4^{3-}$       [C]  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{BiH}_3$       [D]  $\text{CO}$ ,  $\text{NO}$ ,  $\text{CO}_2$ ,  $\text{NO}_2$
- Solution:** C, N and O lack d-orbital hence there is no  $d\pi - p\pi$  bonding in compounds of N and O.  
 Thus,  $d\pi - p\pi$  is in  $\text{P}_2\text{O}_3$ ,  $\text{P}_2\text{O}_5$  and  $\text{PO}_4^{3-}$

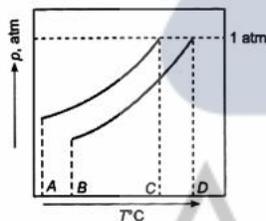
- (49) Which element has the highest first IP?  
 [A] N      [B] Ne      \* [C] He      [D] H
- (50) Water softener is  
 [A] borax      [B] zeolite      \* [C] Both a and b      [D] None of these
- (51) The configuration  $1s^2, 2s^2 2p^5, 3s^1$  show  
 [A] excited state of  $\text{O}_2^-$       \* [B] excited state of neon atom      [C] excited state of fluorine atom      [D] ground state of fluorine atom
- (52) Of the following complex ions one exhibits optical isomerism. That one is  
 \* [A]  $\text{cis}[\text{Co}(\text{en})_2\text{Cl}_2]^+$       [B]  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$       [C]  $[\text{Co}(\text{NH}_3)_2\text{Cl}_4]^-$       [D]  $\text{trans}[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- (53) The diamagnetic ion is  
 [A]  $\text{Fe}^{3+}$       [B]  $\text{Sc}^{2+}$       [C]  $\text{Fe}^{2+}$       \* [D]  $\text{Zn}^{2+}$
- (54) Which is not the resonance structure of aniline?



- (55) Which of the following metals have only one oxidation state?  
 [A] Co      [B] Fe      [C] Sc      \* [D] Al
- (56)  $\text{P}_4\text{O}_{10}$  is converted to white phosphorus by  
 [A] Al      \* [B] C      [C] Na      [D] All of these
- (57) Bleaching powder ( $\text{CaOCl}_2$ ) has two types of chlorine atoms with oxidation number of +1 and -1. It can be represented as  
 [A]  $\text{Ca}^{2+}(\text{ClO})\text{Cl}^-$       [B]  $\text{Ca}^{2+}(\text{ClO}_3)\text{Cl}^-$       [C]  $\text{Ca}^{2+}(\text{ClO}^+)\text{Cl}^-$       \* [D]  $\text{Ca}^{2+}(\text{ClO}^-)\text{Cl}^-$

**Solution:**  $\text{Ca}^{2+}(\text{ClO}^-)(\text{Cl}^-)$

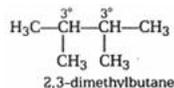
- (58) What is the normal boiling point of the solution represented by the phase diagram?



- [A] A      [B] B      [C] C      \* [D] D
- (59) Which is not the Wurtz-Fittig reaction?  
 \* [A]      [B]      [C]      [D] None of these

**Solution:** It is Wurtz reaction, both alkyl halide being aliphatic.

- (60)  $\text{C}_6\text{H}_{14}$  has two tertiary carbons. The IUPAC name is  
 [A] n-hexane      [B] 2-methylpentane      [C] 3-methylpentane      \* [D] 2,3-dimethylbutane
- Solution:** There are two tertiary carbon atoms thus each carbon is joined to three carbon atoms. Thus,



## Q-2. NUMERICAL TYPE QUESTIONS

- (61) If all the aldehyde isomers of  $\text{C}_5\text{H}_{10}\text{O}$  is independently treated with  $\text{HCN}/\text{NaCN}$  solution, how many of them will give racemic mixture of cyanohydrin?  
**Answer:** 3
- (62) What is the number of oxygen atoms which are shared between tetrahedrons in  $\text{Si}_3\text{O}_9^{6-}$ ?  
**Answer:** 3

- (63) Which of the following compounds are amphoteric in nature? PbO, PbO<sub>2</sub>, SnO, SnO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, ZnO, BeO, Ga<sub>2</sub>O<sub>3</sub>, B<sub>2</sub>O<sub>3</sub>.  
**Answer:** 8
- (64) The number of unpaired electrons present in [NiF<sub>6</sub>]<sup>2-</sup> is .....  
**Answer:** 0
- (65) How many of the following minerals are oxides of metals/ metalloids. (a) Bauxite (b) Corundum (c) Dolomite (d) Malachite (e) Magnetite (f) Pyrolusite (g) Argentite (h) Horn silver (i) Quartz (j) Cryolite (k) Siderite (l) Zincite (m) Calamine (n) Sylvine (o) Carnellite  
**Answer:** 6
- (66) In the complex Fe(CO)<sub>x</sub>, the value of x is:.....  
**Answer:** 5
- (67) How many of the following undergo mutarotation? Amylose, starch, glucose, maltose, cellulose, fructose, galactose, lactose.  
**Answer:** 5
- (68) In reaction of C<sub>6</sub>H<sub>5</sub>COCH<sub>3</sub> with KOH-I<sub>2</sub> to form iodoform, how many moles of KOH are consumed per mole of ketone?  
**Answer:** 4
- (69) How much water in mL must be added to 300 mL of 0.2 M solution of CH<sub>3</sub>COOH ( $K_a = 1.8 \times 10^{-5}$ ) for the degree of ionisation ( $\alpha$ ) of the acid to Triple.  
**Answer:** 2400
- (70) 200 mL of a saturated solution of CaC<sub>2</sub>O<sub>4</sub>(s) requires 8 mL of  $5 \times 10^{-3}$  (N) KMnO<sub>4</sub> solution for complete oxidation in the presence of acid. Determine the (-log K<sub>sp</sub>) value of a saturated solution of CaC<sub>2</sub>O<sub>4</sub>(s) in nearest possible integers.  
**Answer:** 8
- (71) How many amide isomers exist for C<sub>4</sub>H<sub>9</sub>ON that do not form amine on treatment with Br<sub>2</sub>-NaOH?  
**Answer:** 6
- (72) How many different alcohol isomers with molecular formula C<sub>5</sub>H<sub>12</sub>O can be oxidised to ketones using K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>-H<sub>2</sub>SO<sub>4</sub>?  
**Answer:** 5
- (73) An alcohol X(C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>) is chiral and absorbs two moles of HIO<sub>4</sub> per mole of X. How many stereoisomers exist for X?  
**Answer:** 4
- (74) An aqueous solution containing 5% by weight of urea and 10% by weight of glucose. What will be the  $\Delta T_f$  of solution?  $K_f^o$  for H<sub>2</sub>O is 1.86° mol<sup>-1</sup> kg?  
**Answer:** 3
- (75) The vapour pressure of two pure liquids A and B, that form an ideal solution are 100 and 900 mm Hg respectively at temperature T. This liquid solution of A and B is composed of 1 mole of A and 1 mole of B. What will be the pressure, in mm Hg when 1 mole of mixture has been vaporised?  
**Answer:** 300

