

IITJEE 2009

Paper 1 Code (0)

Chemistry

1. Given that the abundances of isotopes ^{54}Fe , ^{56}Fe and ^{57}Fe are 5%, 90% and 5%, respectively, the atomic mass of Fe is
- (A) 55.85 (B) 55.95 (C) 55.75 (D) 56.05

1. Atomic mass = $\sum X_i A_i$

$$= 54 \times 0.05 + 56 \times 0.9 + 57 \times 0.05$$

$$= 55.95$$

Ans: (B)

2. The term that corrects for the attractive forces present in a real gas in the van der Waals equation is
- (A) nb (B) $\frac{an^2}{V^2}$ (C) $-\frac{an^2}{V^2}$ (D) $-nb$

2. The term for the attractive forces present in a real gas in van der Waals equation is:

$$\left(P + \frac{an^2}{V^2} \right) (V - nb) = nRT$$

$\frac{an^2}{V^2}$

Ans: (B)

3. Among the electrolytes Na_2SO_4 , CaCl_2 , $\text{Al}_2(\text{SO}_4)_3$ and NH_4Cl , the most effective coagulating agent for Sb_2S_3 sol is
- (A) Na_2SO_4 (B) CaCl_2 (C) $\text{Al}_2(\text{SO}_4)_3$ (D) NH_4Cl

3: Sb_2S_3 is a negatively charged sol. To coagulate it most effectively, charge on cation should be maximum. Thus, Al^{3+} in $Al_2(SO_4)_3$ will be most effective.
Ans: (C)

1.0 × 10⁻⁴ atm. The moles of air dissolved in 10 moles of water at 298 K and 5 atm pressure is
 (A) 4.0 × 10⁻⁴ (B) 4.0 × 10⁻⁵ (C) 5.0 × 10⁻⁴ (D) 4.0 × 10⁻⁶

4: Henry's law:
$$P_{\text{partial}} = P_H \cdot (X_{N_2})_{\text{in sol}^n}$$

 Pressure of N_2

$$5 \times 0.8 = 10 \times X_{N_2} \text{ in sol}^n$$

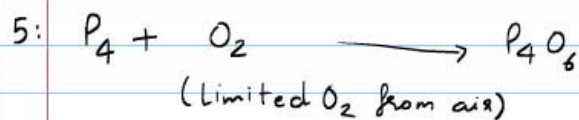
$$P_{\text{Total}} \cdot (X_{N_2})_{\text{in air}}$$

$$\Rightarrow X_{N_2} = 4 \times 10^{-5} = \frac{n_{N_2}}{n_{N_2} + n_{O_2}} \approx \frac{n_{N_2}}{n_{O_2}}$$

$$\Rightarrow n_{N_2} = 4 \times 10^{-4}$$

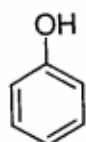
Ans: (A)

5. The reaction of P_4 with X leads selectively to P_4O_6 . The X is
 (A) Dry O_2 (B) A mixture of O_2 and N_2
 (C) Moist O_2 (D) O_2 in the presence of aqueous NaOH

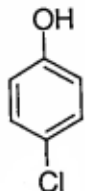


Ans: (B)

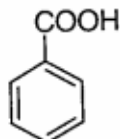
6. The correct acidity order of the following is



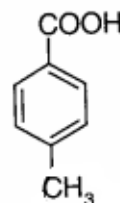
(I)



(II)

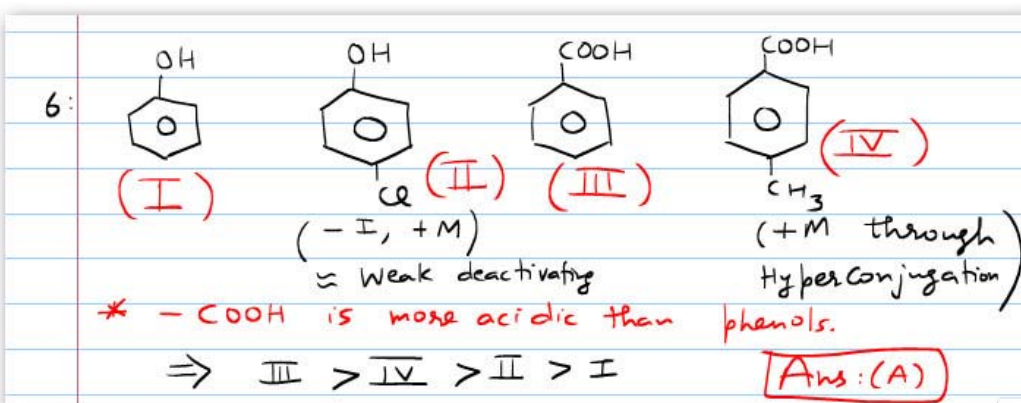


(III)



(IV)

- (A) (III) > (IV) > (II) > (I) (B) (IV) > (III) > (I) > (II)
 (C) (III) > (II) > (I) > (IV) (D) (II) > (III) > (IV) > (I)



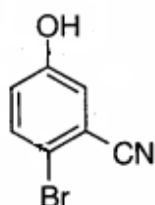
7. Among cellulose, poly(vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is

- (A) Nylon (B) Poly(vinyl chloride)
 (C) Cellulose (D) Natural Rubber

7: Natural rubber is a polymer of isoprene.
 Nylon, Cellulose & PVC contains functional groups.

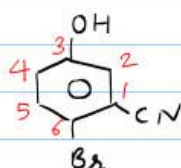
Ans: (D)

8. The IUPAC name of the following compound is



- (A) 4-Bromo-3-cyanophenol
 (B) 2-Bromo-5-hydroxybenzonitrile
 (C) 2-Cyano-4-hydroxybromobenzene
 (D) 6-Bromo-3-hydroxybenzonitrile

8:



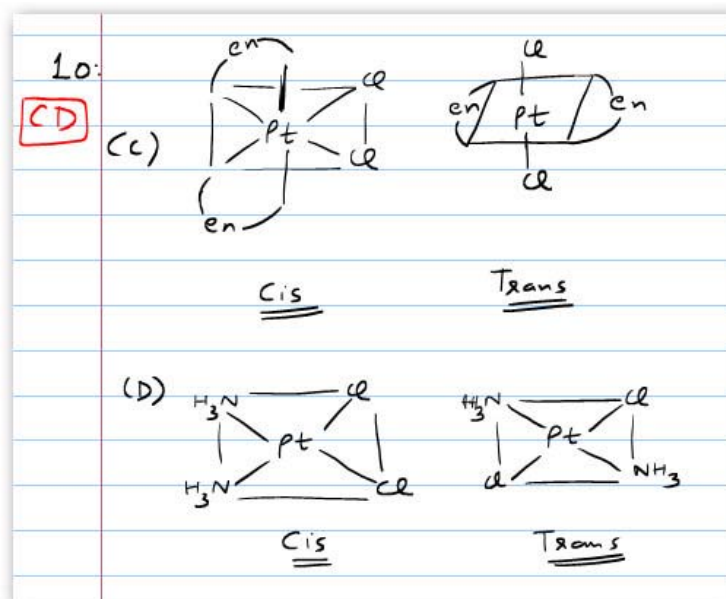
Clearly, the IUPAC name is:

6-Bromo-3-hydroxybenzonitrile

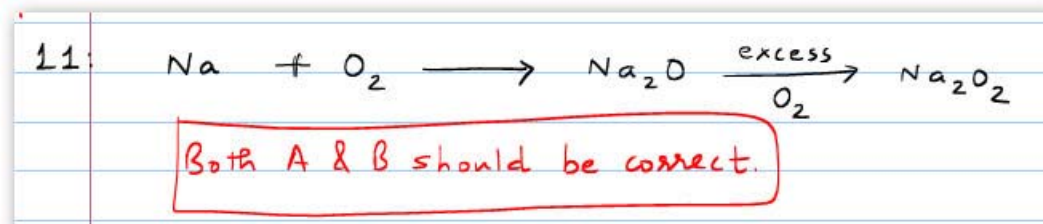
Ans: (D)

9. The correct statement(s) regarding defects in solids is(are)
- (A) Frenkel defect is usually favoured by a very small difference in the sizes of cation and anion
 (B) Frenkel defect is a dislocation defect
 (C) Trapping of an electron in the lattice leads to the formation of F-center
 (D) Schottky defects have no effect on the physical properties of solids

10. The compound(s) that exhibit(s) geometrical isomerism is(are)
- (A) $[\text{Pt}(\text{en})\text{Cl}_2]$ (B) $[\text{Pt}(\text{en})_2]\text{Cl}_2$
- (C) $[\text{Pt}(\text{en})_2\text{Cl}_2]\text{Cl}_2$ (D) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$



11. The compound(s) formed upon combustion of sodium metal in excess air is(are)
- (A) Na_2O_2 (B) Na_2O (C) NaO_2 (D) NaOH



12. The correct statement(s) about the compound $\text{H}_3\text{C}(\text{HO})\text{HC}-\text{CH}=\text{CH}-\text{CH}(\text{OH})\text{CH}_3$ (**X**) is(are)
- (A) The total number of stereoisomers possible for **X** is 6
- (B) The total number of diastereomers possible for **X** is 3
- (C) If the stereochemistry about the double bond in **X** is *trans*, the number of enantiomers possible for **X** is 4
- (D) If the stereochemistry about the double bond in **X** is *cis*, the number of enantiomers possible for **X** is 2

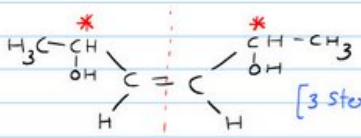
12: $\text{CH}_3 - \overset{*}{\underset{\text{OH}}{\text{CH}}} - \text{CH} = \text{CH} - \overset{*}{\underset{\text{OH}}{\text{CH}}} - \text{CH}_3$

Ans: C D

(X)

Total number of chiral centres = 2

Cis:



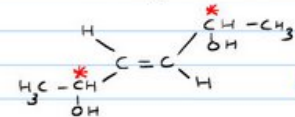
[3 stereoisomers]

σ (Plane of Symmetry)

(Meso compound)

\Rightarrow There are only two enantiomers for X.

Trans:



Four enantiomers
& stereoisomers are possible.

\Rightarrow Total stereoisomers = 3 + 4 = 7

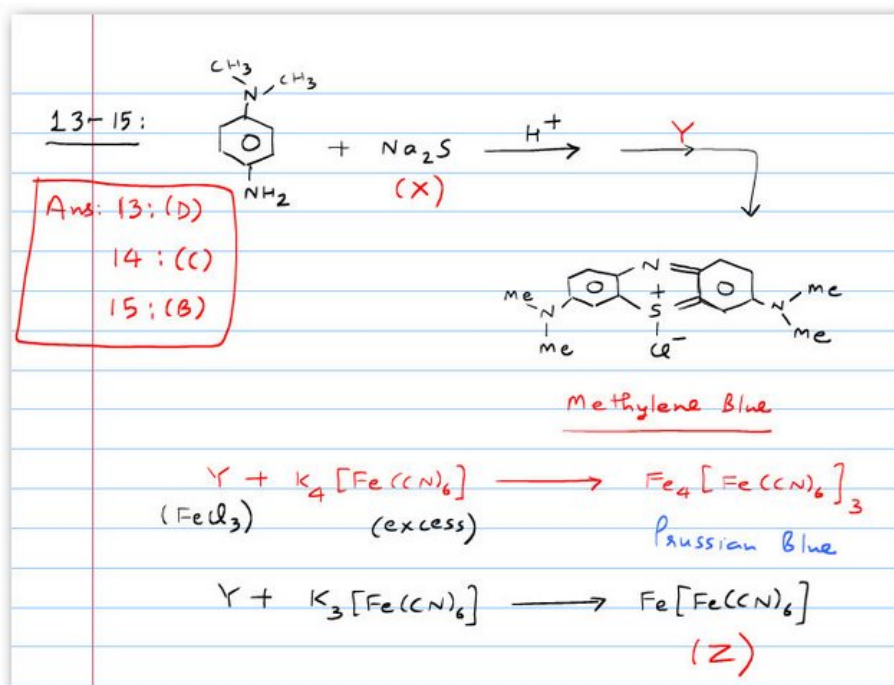
There will be lot of diastereomers.

Paragraph for Question Nos. 13 to 15

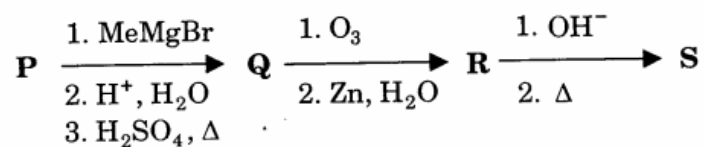
p-Amino-*N,N*-dimethylaniline is added to a strongly acidic solution of **X**. The resulting solution is treated with a few drops of aqueous solution of **Y** to yield blue coloration due to the formation of methylene blue. Treatment of the aqueous solution of **Y** with the reagent potassium hexacyanoferrate(II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, treatment of the solution of **Y** with the solution of potassium hexacyanoferrate(III) leads to a brown coloration due to the formation of **Z**.

13. The compound **X** is
- (A) NaNO_3 (B) NaCl (C) Na_2SO_4 (D) Na_2S

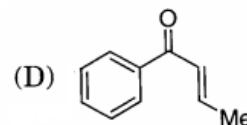
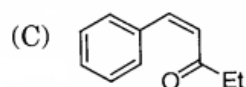
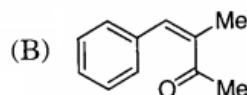
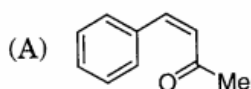
14. The compound **Y** is
 (A) MgCl_2 (B) FeCl_2 (C) FeCl_3 (D) ZnCl_2
15. The compound **Z** is
 (A) $\text{Mg}_2[\text{Fe}(\text{CN})_6]$ (B) $\text{Fe}[\text{Fe}(\text{CN})_6]$
 (C) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (D) $\text{K}_2\text{Zn}_3[\text{Fe}(\text{CN})_6]_2$



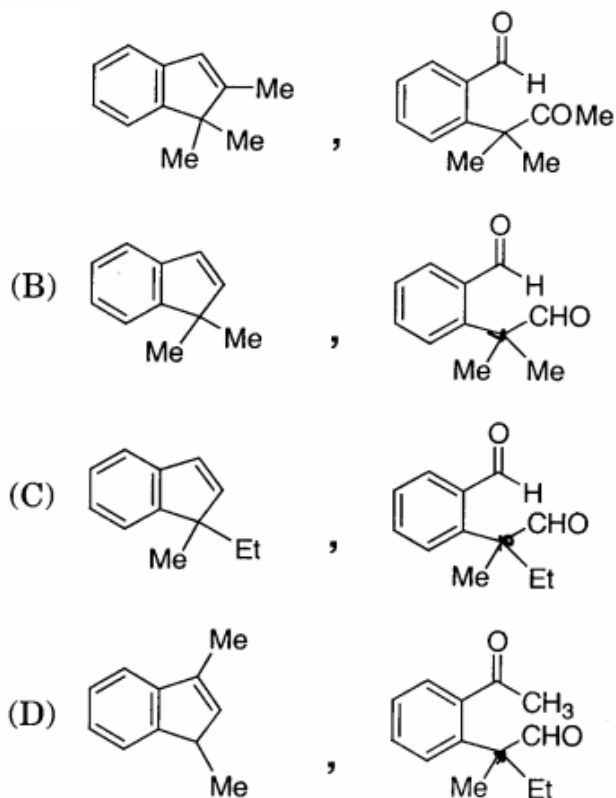
A carbonyl compound **P**, which gives positive iodoform test, undergoes reaction with MeMgBr followed by dehydration to give an olefin **Q**. Ozonolysis of **Q** leads to a dicarbonyl compound **R**, which undergoes intramolecular aldol reaction to give predominantly **S**.



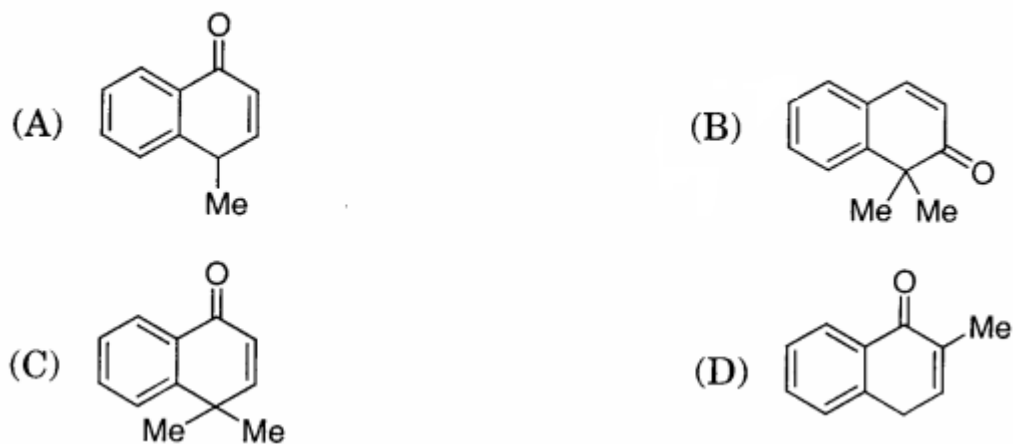
16. The structure of the carbonyl compound **P** is

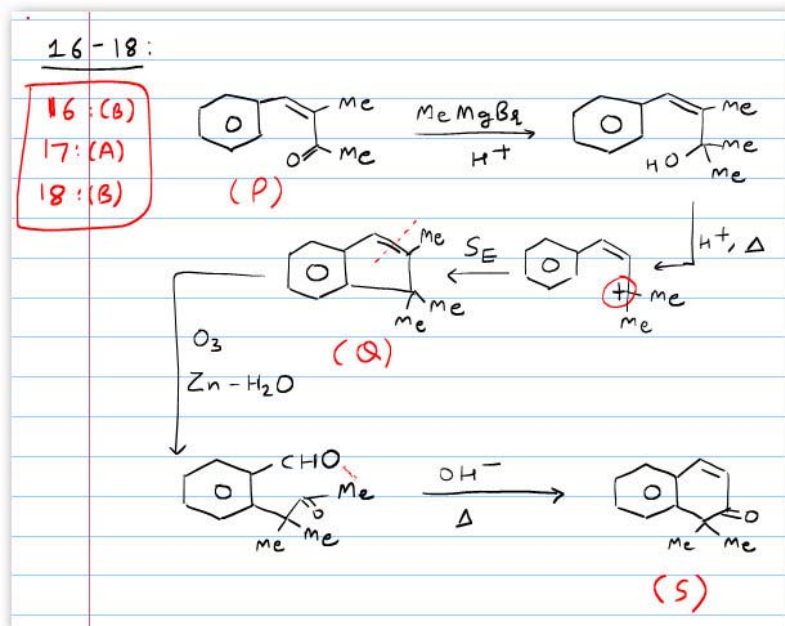


17. The structures of the products **Q** and **R**, respectively, are



18. The structure of the product **S** is





19. Match each of the diatomic molecules in **Column I** with its property/properties in **Column II**.

Column I

- (A) B₂
(B) N₂
(C) O₂⁻
(D) O₂

Column II

- (p) Paramagnetic
(q) Undergoes oxidation
(r) Undergoes reduction
(s) Bond order ≥ 2
(t) Mixing of 's' and 'p' orbitals

19:
 Ans: (A): p, q
 (B): s
 (C): p, q
 (D): p, q, s

In M.O. theory,
 's' overlaps with 's'
 & 'p' overlaps with 'p'

B_2 : B.O. = 1 (No. of unpaired e⁻s = 2)
 ⇒ Paramagnetic
 Adding one e⁻ will go in bonding orbital.

N_2 : B.O. = 3
 Adding/removing an e⁻ will reduce its bond order.

O_2^- : B.O. = 1.5
 ↓
 Paramagnetic
 ↑
 O_2 : B.O. = 2

will prefer the removal of e⁻ from antibonding orbitals

20. Match each of the compounds in **Column I** with its characteristic reaction(s) in **Column II**.

Column I

- (A) $CH_3CH_2CH_2CN$
 (B) $CH_3CH_2OCOCH_3$
 (C) $CH_3 - CH = CH - CH_2OH$
 (D) $CH_3CH_2CH_2CH_2NH_2$

Column II

- (p) Reduction with Pd - C/H₂
 (q) Reduction with SnCl₂/HCl
 (r) Development of foul smell on treatment with chloroform and alcoholic KOH
 (s) Reduction with diisobutylaluminium hydride (DIBAL - H)
 (t) Alkaline hydrolysis

