

**CHEMISTRY**  
**JEE-MAIN (January-Attempt) 12**  
**January (Shift-1) Paper**

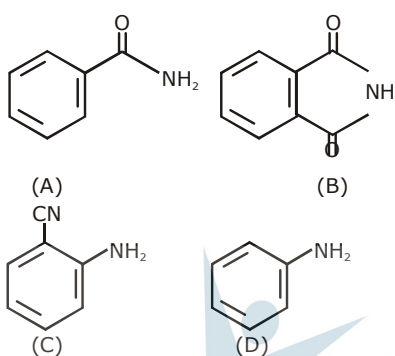
**SECTION - A**

1. The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. The pressure of the gases for equal number of moles are :  
 (A)  $P_A = 2P_B$       (B)  $3P_A = 2P_B$       (C)  $2P_A = 3P_B$       (D)  $P_A = 3P_B$

**Sol. C**

$$\begin{aligned} V_A &= 2V_B \\ Z_A &= 3Z_B \\ \frac{P_A V_A}{n_A R T_A} &= \frac{3 \cdot P_B \cdot V_B}{n_B \cdot R T_B} \\ &= 2P_A = 3P_B \end{aligned}$$

2. The increasing order of reactivity of the following compounds towards reaction with alkyl halides directly is :

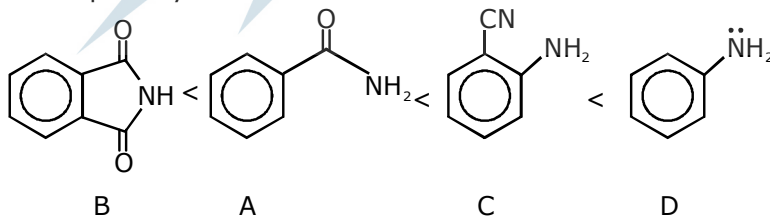


(A)  $(A) < (B) < (C) < (D)$   
 (C)  $(B) < (A) < (D) < (C)$

(B)  $(B) < (A) < (C) < (D)$   
 (D)  $(A) < (C) < (D) < (B)$

**Sol. B**

Nucleophilicity order

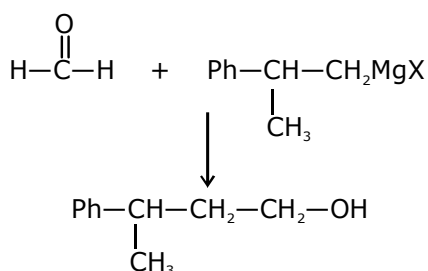


3.  $\text{CH}_3\text{CH}_2-\overset{\text{OH}}{\underset{\text{Ph}}{\text{C}}}-\text{CH}_3$  cannot be prepared by :

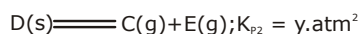
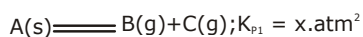
(A)  $\text{HCHO} + \text{PhCH}(\text{CH}_3)\text{CH}_2\text{MgX}$   
 (C)  $\text{PhCOCH}_3 + \text{CH}_3\text{CH}_2\text{MgX}$

(B)  $\text{PhCOCH}_2\text{CH}_3 + \text{CH}_3\text{MgX}$   
 (D)  $\text{CH}_3\text{CH}_2\text{COCH}_3 + \text{PhMgX}$

**Sol. A**



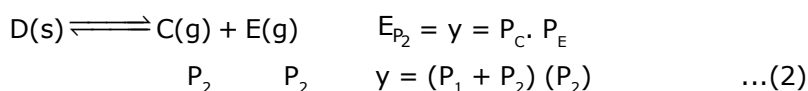
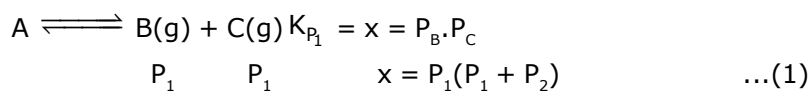
4. Two solids dissociate as follows



The total pressure when both the solids dissociate simultaneously is :

- (A)  $(x+y)\text{atm}$  (B)  $x^2 + y^2 \text{atm}$   
 (C)  $\sqrt{x+y} \text{atm}$  (D)  $2(\sqrt{x+y}) \text{atm}$

Sol. D



Adding (1) and (2)

$$x + y = (P_1 + P_2)^2$$

Now total pressure

$$P_T = P_C + P_B + P_E$$

$$= (P_1 + P_2) + P_1 + P_2 = 2(P_1 + P_2)$$

$$P_T = 2(\sqrt{x+y})$$

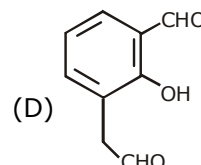
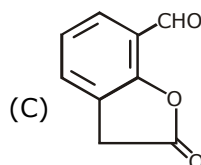
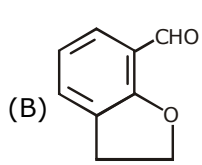
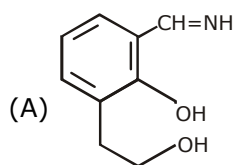
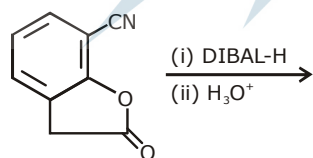
5. In the Hall-Heroult process, aluminium is formed at the cathode. The cathode is made out of :

- (A) Copper (B) Platinum (C) Pure aluminium (D) Carbon

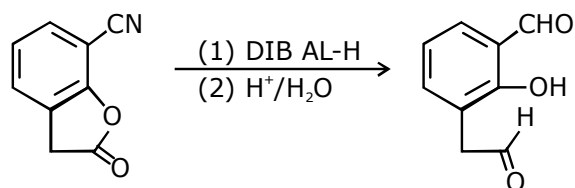
Sol. D

In the Hall-Heroult process the cathode is made of carbon.

6. The major product of the following reaction is :



Sol. D



DIBAL-H will reduce cyanides & esters to aldehydes.

7. The molecule that has minimum/no role in the formation of photochemical smog, is :  
 (A) O<sub>3</sub> (B) N<sub>2</sub> (C) CH<sub>2</sub>=O (D) NO

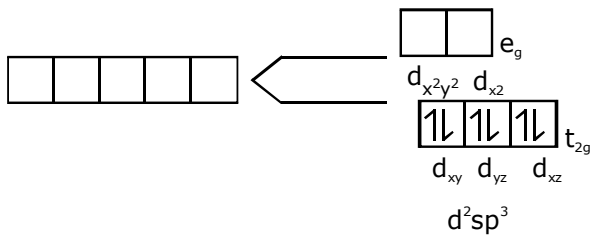
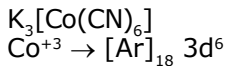
Sol. **B**

Chiefly NO<sub>2</sub>, O<sub>3</sub> and hydrocarbon are responsible for build up smog.

8. The metal d-orbitals that are directly facing the ligands in K<sub>3</sub>[Co(CN)<sub>6</sub>] are :

(A) d<sub>xy</sub> and d<sub>x<sup>2</sup>-y<sup>2</sup></sub> (B) d<sub>x<sup>2</sup>-y<sup>2</sup></sub> and d<sub>z<sup>2</sup></sub> (C) d<sub>xy</sub>, d<sub>xz</sub> and d<sub>yz</sub> (D) d<sub>xz</sub>, d<sub>yz</sub> and d<sub>z<sup>2</sup></sub>

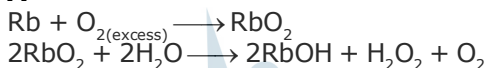
Sol. **B**



9. A metal on combustion in excess air forms X. X upon hydrolysis with water yields H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub> along with another product. The metal is :

(A) Rb (B) Mg (C) Na (D) Li

Sol. **A**



10. Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous solution of Y. If molecular weight of X is A, then molecular weight of Y is :

(A) 3A (B) A (C) 4A (D) 2A

Sol. **A**

For same freezing point, molality of both solution should be same.

$$m_x = m_y$$

$$\frac{4 \times 1000}{96 \times M_x} = \frac{12 \times 1000}{88 \times M_y}$$

$$\text{or, } M_y = \frac{96 \times 12}{4 \times 88} M_x = 3.27 A$$

Closest option is 3A.

11. Decomposition of X exhibits a rate constant of 0.05 μg/year. How many years are required for the decomposition of 5 μg of X into 2.5 μg ?

(A) 50 (B) 25 (C) 40 (D) 20

Sol. **A**

Rate constant (K) = 0.05 μg/year  
 means zero order reaction

$$t_{1/2} = \frac{a_0}{2K} = \frac{5\mu\text{g}}{2 \times 0.05\mu\text{g}/\text{year}} = 50 \text{ year}$$

12. The element with Z = 120 (not yet discovered) will be an/a :

(A) alkali metal (B) alkaline earth metal  
 (C) transition metal (D) inner-transition metal

Sol. **B**

Z = 120

Its general electronic configuration may be represented as [Nobal gas] ns<sup>2</sup>, like other alkaline earth metals.

- 13.** What is the work function of the metal if the light of wavelength  $4000\text{\AA}$  generates photoelectrons of velocity  $6 \times 10^5 \text{ ms}^{-1}$  from it ?  
 Mass of electron =  $9 \times 10^{-31} \text{ kg}$   
 Velocity of light =  $3 \times 10^8 \text{ ms}^{-1}$   
 Planck's constant =  $6.626 \times 10^{-34} \text{ Js}$   
 Charge of electron =  $1.6 \times 10^{-19} \text{ JeV}^{-1}$   
 (A) 2.1 eV (B) 0.9 eV (C) 3.1 eV (D) 4.0 eV

**Sol. A**  
 $h\nu = \phi + h\nu^0$

$$\frac{1}{2}mv^2 = hc\left(\frac{1}{\lambda} + \frac{1}{\lambda_0}\right)$$

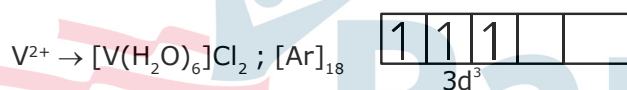
$$h\nu = \phi + \frac{1}{2}mv^2$$

$$\phi = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{4000 \times 10^{-10}} - \frac{1}{2} \times 9 \times 10^{-31} \times (6 \times 10^5)^2$$

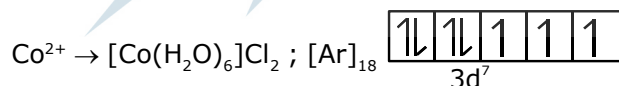
$$\phi = 3.35 \times 10^{-19} \text{ J} \Rightarrow \phi \approx 2.1 \text{ eV}$$

- 14.** The pair of metal ions that can give a spin only magnetic moment of 3.9 BM for the complex  $[\text{M}(\text{H}_2\text{O})_6]\text{Cl}_2$ , is :  
 (A)  $\text{Co}^{2+}$  and  $\text{Fe}^{2+}$  (B)  $\text{V}^{2+}$  and  $\text{Fe}^{2+}$  (C)  $\text{V}^{2+}$  and  $\text{Co}^{2+}$  (D)  $\text{Cr}^{2+}$  and  $\text{Mn}^{2+}$

**Sol. C**  
 $\text{V}^{2+}$  and  $\text{Co}^{2+}$

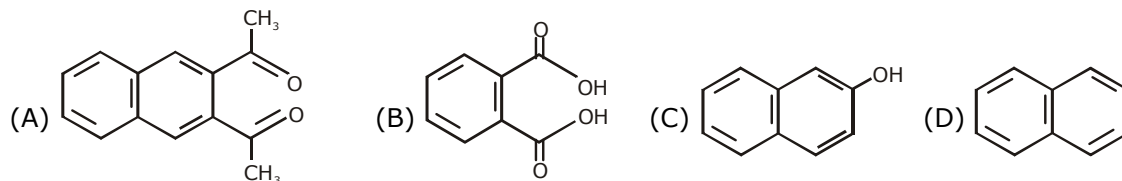


3 unpaired  $e^-$ , spin only  
 magnetic moment  
 = 3.89 B.M.



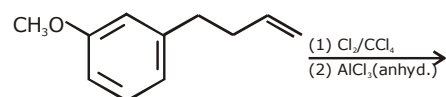
3 unpaired  $e^-$ , spin only  
 magnetic moment  
 = 3.89 B.M.

- 15.** Among the following four aromatic compounds, which one will have the lowest melting point ?

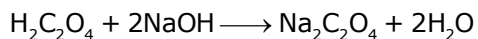


**Sol. D**  
 M.P. of Naphthalene  $\approx 80^\circ\text{C}$

- 16.** The major product of the following reaction is :







$$m_{\text{eq}} \text{ of } \text{H}_2\text{C}_2\text{O}_4 = m_{\text{eq}} \text{ NaOH}$$

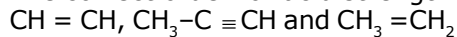
$$50 \times 0.5 \times 2 = 25 \times M_{\text{NaOH}} \times 1$$

$$\therefore M_{\text{NaOH}} = 2 \text{ M}$$

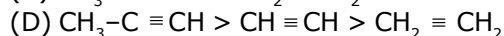
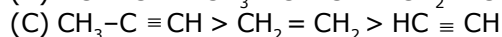
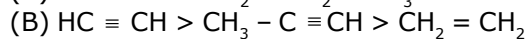
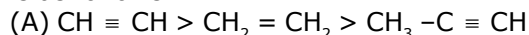
$$\text{Now } 1000 \text{ ml solution} = 2 \times 40 \text{ gram NaOH}$$

$$\therefore 50 \text{ ml solution} = 4 \text{ gram NaOH}$$

19. The correct order for acid strength of compounds

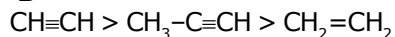


is as follows :



Sol.

**B**



(Acidic strength order)

20. Water samples with BOD values of 4 ppm and 18 ppm, respectively, are :

(A) Highly polluted and Highly polluted

(B) Clean and Clean

(C) Clean and Highly polluted

(D) Highly polluted and Clean

Sol.

**C**

Clean water would have BOD value of less than 5 ppm whereas highly polluted water could have a BOD value of 17 ppm or more.

21.  $\text{Mn}_2(\text{CO})_{10}$  is an organometallic compound due to the presence of :

(A) Mn-C bond

(B) Mn-O bond

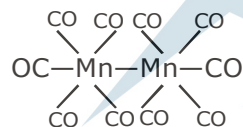
(C) C-O bond

(D) Mn-Mn bond

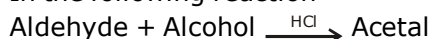
Sol.

**A**

Compounds having at least one bond between carbon and metal are known as organometallic compounds.

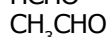


22. In the following reaction



Aldehyde

Alcohol



The best combination is :

(A)  $\text{CH}_3\text{CHO}$  and  $t_{\text{BuOH}}$

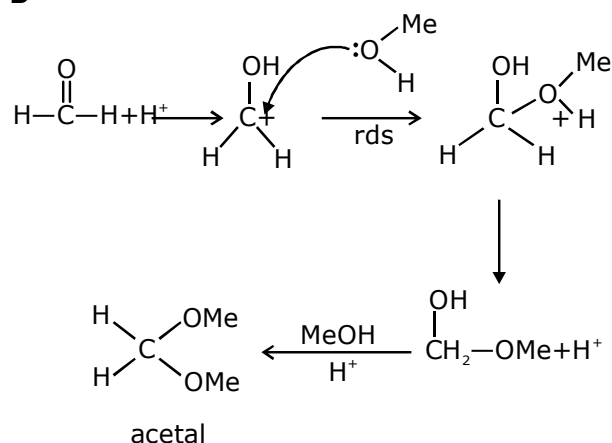
(B)  $\text{HCHO}$  and  $\text{MeOH}$

(C)  $\text{CH}_3\text{CHO}$  and  $\text{MeOH}$

(D)  $\text{HCHO}$  and  $t_{\text{BuOH}}$

Sol.

**B**



$$\text{rate} \propto \frac{1}{\text{steric crowding of aldehyde}}$$

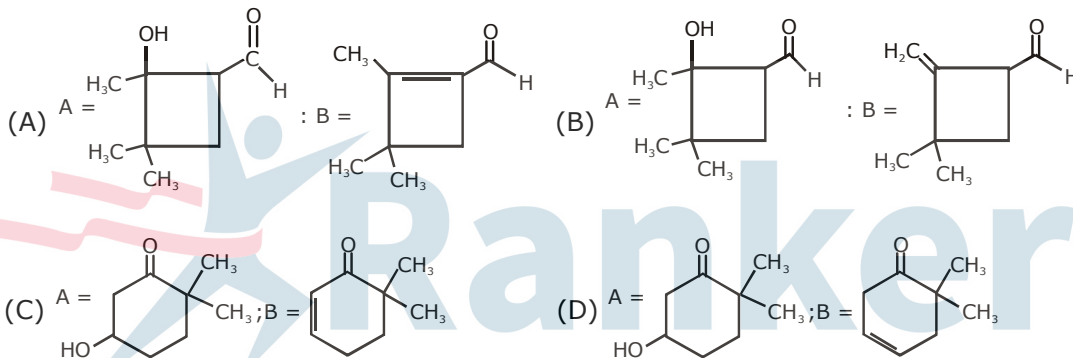
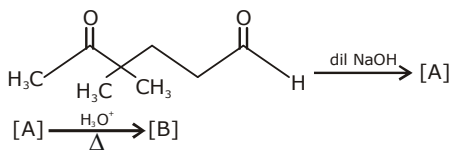
t-butanol can show formation of carbocation in acidic medium

- 23.** Poly- $\beta$  hydroxybutyrate-co- $\beta$ -hydroxyvalerate (PHBV) is a copolymer of \_\_\_\_\_.
- (A) 3-hydroxybutanoic acid and 4-hydroxypentanoic acid  
 (B) 2-hydroxybutanoic acid and 3-hydroxypentanoic acid  
 (C) 3-hydroxybutanoic acid and 2-hydroxypentanoic acid  
 (D) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid

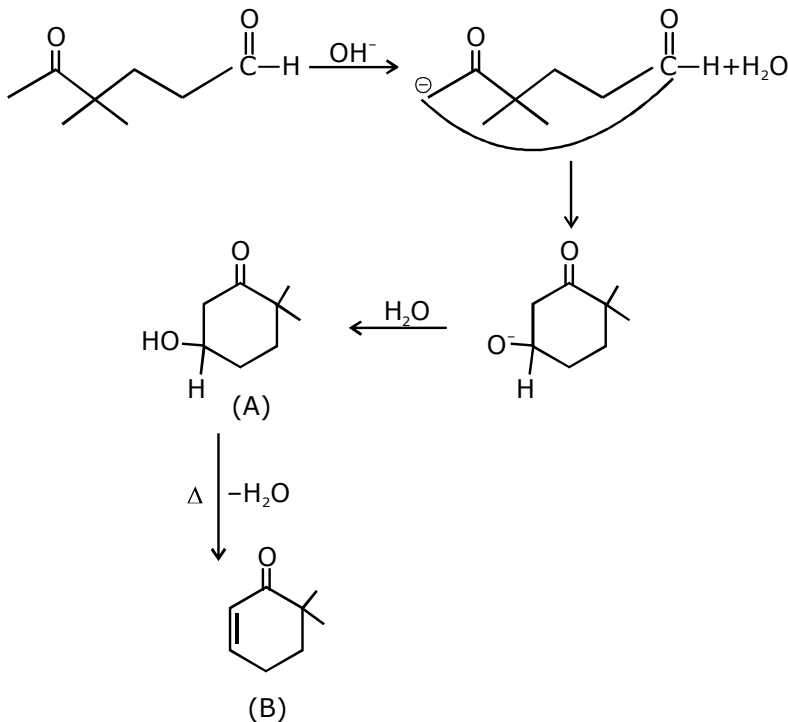
**Sol. D**

PHBV is a polymer of 3-hydroxybutanoic acid and 3-Hydroxy pentanoic acid.

- 24.** In the following reactions, products A and B are :

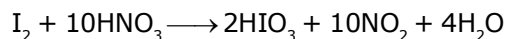


**Sol. C**



25. Iodine reacts with concentrated  $\text{HNO}_3$  to yield Y along with other products. The oxidation state of iodine in Y, is :
- (A) 5                      (B) 1                      (C) 3                      (D) 7

Sol. A



In  $\text{HIO}_3$  oxidation state of iodine is +5.

26. Given

Gas	$\text{H}_2$	$\text{CH}_4$	$\text{CO}_2$	$\text{SO}_2$
Critical Temperature/K	33	190	304	630

Temperature/K

On the basis of data given above, predict which of the following gases shows least adsorption on a definite amount of charcoal ?

- (A)  $\text{SO}_2$                       (B)  $\text{CH}_4$   
 (C)  $\text{CO}_2$                       (D)  $\text{H}_2$

Sol. D

Smaller the value of critical temperature of gas, lesser is the extent of adsorption. so least adsorbed gas is  $\text{H}_2$

27. Among the following compounds most basic amino acid is :

- (A) Asparagine                      (B) Lysine                      (C) Histidine                      (D) Serine

Sol. B

Lysine

28. In a chemical reaction,  $\text{A} + 2\text{B} \xrightleftharpoons{K} 2\text{C} + \text{D}$ , the initial concentration of B was 1.5 times of the concentration of A, but the equilibrium concentrations of A and B were found to be equal. The equilibrium concentrations of A and B were found to be equal. The equilibrium constant(K) for the aforesaid chemical reaction is :

- (A) 16                      (B) 1                      (C) 1/4                      (D) 4

Sol. D

	A	+	2B	$\rightleftharpoons$	2C	+	D
t=0	$a_0$		$1.5a_0$		0		0
t = $t_{\text{eq}}$	$a_0 - x$		$1.5a_0 - 2x$		2x		x

At equilibrium  $[\text{A}] = [\text{B}]$

$$a_0 - x = 1.5a_0 - 2x \Rightarrow x = 0.5 a_0$$

$$K_c = \frac{[\text{C}]^2 [\text{D}]}{[\text{A}] [\text{B}]^2} = \frac{(a_0)^2 (0.5a_0)}{(0.5a_0)(0.5a_0)^2} = 4$$

29. The standard electrode potential  $E^\ominus$  and its temperature coefficient  $(dE^\ominus/dT)$  for a cell are 2 V and  $-5 \times 10^{-4} \text{ V K}^{-1}$  at 300 K respectively. The cell reaction is  $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$ . The standard reaction enthalpy  $(\Delta_r H^\ominus)$  at 300 K in  $\text{kJ mol}^{-1}$  is, [Use  $R = 8 \text{ J K}^{-1} \text{ mol}^{-1}$  and  $F = 96,000 \text{ C mol}^{-1}$ ]
- (A) -412.8                      (B) -384.0                      (C) 192.0                      (D) 206.4

Sol. A

30. The hardness of a water sample (in terms of equivalent of  $\text{CaCO}_3$ ) containing  $10^{-3} \text{ M CaSO}_4$  is : (molar mass of  $\text{CaSO}_4 = 136 \text{ g mol}^{-1}$ )
- (A) 10 ppm                      (B) 100 ppm                      (C) 50 ppm                      (D) 90 ppm

Sol. B

ppm of  $\text{CaCO}_3$   
 $(10^{-3} \times 10^3) \times 100 = 100 \text{ ppm}$

