FINAL JEE–MAIN EXAMINATION – JANUARY, 2019
Held On Saturday 12th JANUARY, 2019
TIME: 09 : 30 AM To 12 : 30 PM

1. Iodine reacts with concentrated HNO_3 to yield Y along with other products. The oxidation state of iodine in Y, is :-

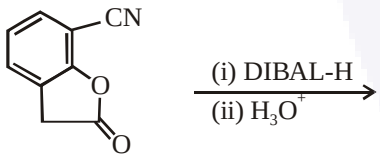
(1) 5 (2) 3 (3) 1 (4) 7

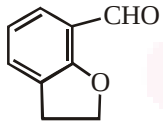
Ans. (1)

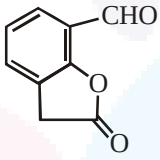
Sol. $I_2 + 10HNO_3 \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$

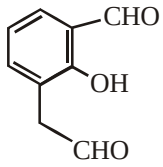
In HIO_3 oxidation state of iodine is +5.

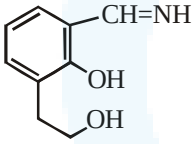
2. The major product of the following reaction is:



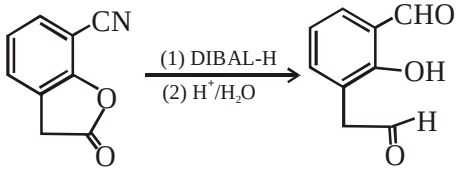
(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. 

DIBAL-H will reduce cyanides & esters to aldehydes.

3. In a chemical reaction, $A + 2B \overset{K}{\rightleftharpoons} 2C + D$, 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 constant(K) for the aforesaid chemical reaction is :

(1) 16 (2) 4 (3) 1 (4) $\frac{1}{4}$

Ans.(2)

Sol.

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

At equilibrium [A] = [B]

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

$t = t_{eq}$	$0.5a_0$	$0.5a_0$	a_0	$0.5a_0$

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

4. Two solids dissociate as follows

$A(s) \rightleftharpoons B(g) + C(g)$; $K_{p_1} = x\ atm^2$

$D(s) \rightleftharpoons C(g) + E(g)$; $K_{p_2} = y\ atm^2$

The total pressure when both the solids dissociate simultaneously is :-

(1) $x^2 + y^2$ atm (2) $x^2 + y^2$ atm

(3) $2\left(\sqrt{x+y}\right)$atm (4) $\sqrt{x+y}$ atm

Ans. (3)

Sol. $A(s) \rightleftharpoons B(g) + C(g)$ $K_{P_1} = x = P_B \cdot P_C$

P_1 P_1 $x = P_1(P_1 + P_2)$ ...(1)

$D(s) \rightleftharpoons C(g) + E(g)$ $K_{P_2} = y = P_C \cdot P_E$

P_2 P_2 $y = (P_1+P_2)\,(P_2)$ ...(2)

Adding (1) and (2)

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

Now total pressure

$P_T = P_C + P_B + P_E$

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

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

5. 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 :-

(1) A

(2) 3A

(3) 4A

(4) 2A

Ans. (2)

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

$m_x = m_y$

$$\frac{4\times1000}{96\times M_x}=\frac{12\times1000}{88\times M_y}$$

or, $M_y = \frac{96\times12}{4\times88}M_x = 3.27\ A$

Closest option is 3A.

6. Poly-β-hydroxybutyrate-co-β-hydroxyvalerate(PHBV) is a copolymer of___.

(1) 3-hydroxybutanoic acid and 4-hydroxypentanoic acid

(2) 2-hydroxybutanoic acid and 3-hydroxypentanoic acid

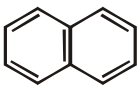
(3) 3-hydroxybutanoic acid and 2-hydroxypentanoic acid

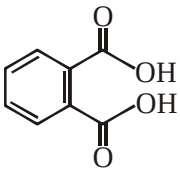
(4) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid

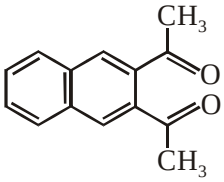
Ans. (4)

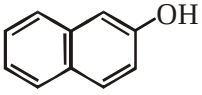
Sol. PHBV is a polymer of 3-hydroxybutanoic acid and 3-Hydroxy pentanoic acid.

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

(1) 

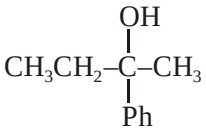
(2) 

(3) 

(4) 

Ans. (1)

Sol. M.P. of Napthalene $\simeq$ 80°C

8.  cannot be prepared by :

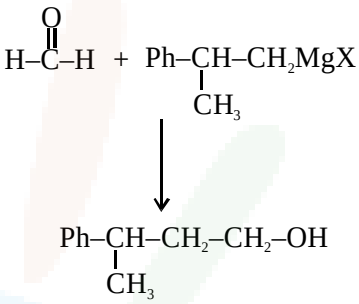
(1) HCHO + $PhCH(CH_3)CH_2MgX$

(2) $PhCOCH_2CH_3 + CH_3MgX$

(3) $PhCOCH_3 + CH_3CH_2MgX$

(4) $CH_3CH_2COCH_3 + PhMgX$

Ans. (1)

Sol. (1) 

9. 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 pressures of the gases for equal number of moles are :

(1) $2P_A = 3P_B$

(2) $P_A = 3P_B$

(3) $P_A = 2P_B$

(4) $3P_A = 2P_B$

Ans. (1)

Sol. $V_A = 2V_B$

$Z_A = 3Z_B$

$$\frac{P_A V_A}{n_A RT_A}=\frac{3\cdot P_B\cdot V_B}{n_B.RT_B}$$

$2P_A = 3P_B$

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

(1) transition metal

(2) inner-transition metal

(3) alkaline earth metal

(4) alkali metal

Ans. (3)

Sol. Z = 120

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

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 ?

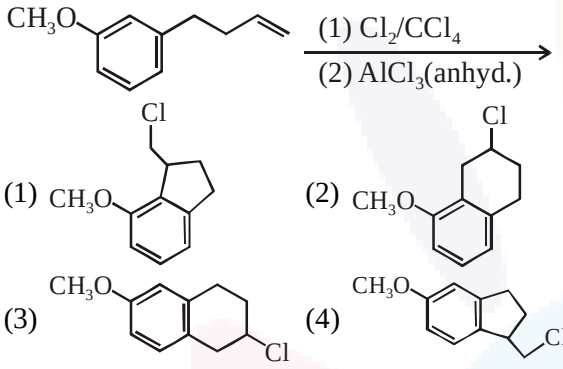
(1) 50 (2) 25 (3) 20 (4) 40

Ans.(1)

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

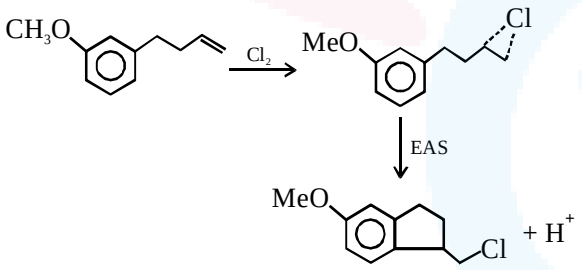
$$t_{1/2}=\frac{a_0}{2K}=\frac{5\mu g}{2\times 0.05\mu g/year}=50\ year$$

12. The major product of the following reaction is :



Ans. (4)

Sol.



13. Given

Gas	H_2	CH_3	CO_2	SO_2
Critical Temperature/K	33	190	304	630

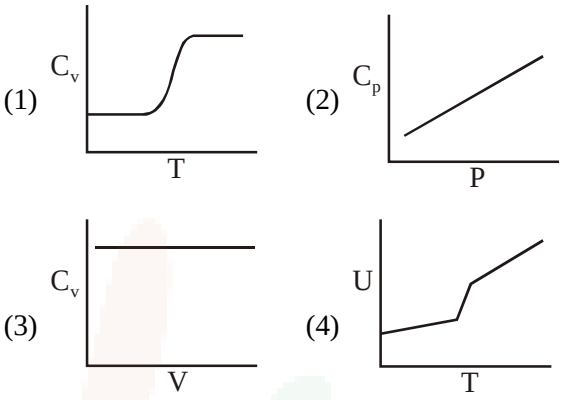
On the basis of data given above, predict which of the following gases shows least adsorption on a definite amount of charcoal ?

(1) H_2 (2) CH_4 (3) SO_2 (4) CO_2

Ans. (1)

Sol. Smaller the value of critical temperature of gas, lesser is the extent of adsorption.
so least adsorbed gas is H_2

14. For diatomic ideal gas in a closed system, which of the following plots does not correctly describe the relation between various thermodynamic quantities ?



Ans. (2)

Sol. At higher temperature, rotational degree of freedom becomes active.

$$C_P=\frac{7}{2}R \quad \text{(Independent of P)}$$

$$C_V=\frac{5}{2}R \quad \text{(Independent of V)}$$

Variation of U vs T is similar as C_V vs T.

15. The standard electrode potential $E^{\ominus}$ and its temeprature coefficient $\left(\frac{dE^{\ominus}}{dT}\right)$ for a cell are 2V and $-5\times10^{-4}\ VK^{-1}$ at 300 K respectively. The cell reaction is

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

The standard reaction enthalpy $\left(\Delta_r H^{\ominus}\right)$ at 300 K in kJ mol^{-1} is,

[Use R = $8jK^{-1}\ mol^{-1}$ and F = 96,000 $Cmol^{-1}$]

(1) –412.8 (2) –384.0
(3) 206.4 (4) 192.0

Ans. (1)

Sol. Chiefly NO_2, O_3 and hydrocarbon are responsible for build up smog.

16. The molecule that has minimum/no role in the formation of photochemical smog, is :
(1) $CH_2 = O$
(2) N_2
(3) O_3
(4) NO

Ans. (2)

Sol. Chiefly NO_2, O_3 and hydrocarbon are responsible for build up smog.

17. In the Hall-Heroult process, aluminium is formed at the cathode. The cathode is made out of :
(1) Platinum
(2) Carbon
(3) Pure aluminium
(4) Copper

Ans. (2)

17. Ans.(2) Carbon

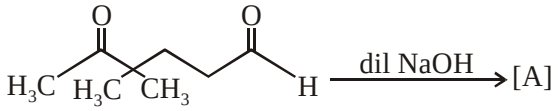
Sol. In the Hall-Heroult process the cathode is made of carbon.

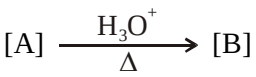
18. Water samples with BOD values of 4 ppm and 18 ppm, respectively, are :
(1) Highly polluted and Clean
(2) Highly polluted and Highly polluted
(3) Clean and Highly polluted
(4) Clean and Clean

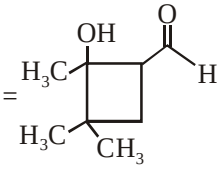
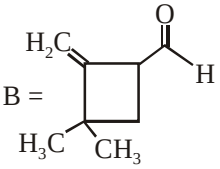
Ans. (3)

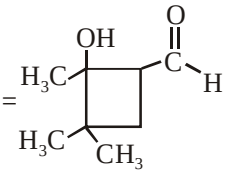
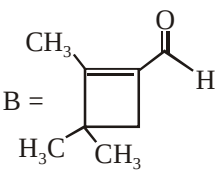
Sol. Clean water would have BOD value of less than 5 ppm whereas highly polluted water could have a BOD value of 17 ppm or more.

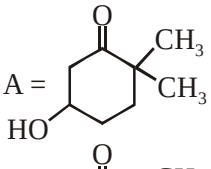
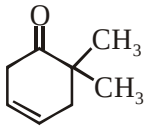
19. In the following reactions, products A and B are :

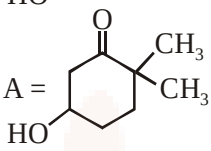
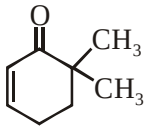




(1) A =  ; B = 

(2) A =  ; B = 

(3) A =  ; B = 

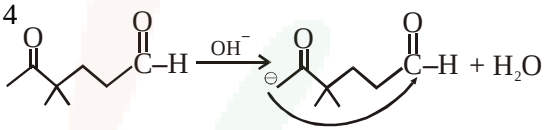
(4) A =  ; B = 

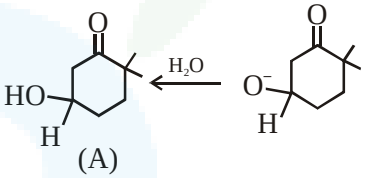
Ans. (4)

19.

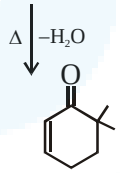
Ans. 4

Sol.





(A)



(B)

20. What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity 6×10^5 ms^{-1} form it ?
(Mass of electron = 9×10^{-31} kg
Velocity of light = 3×10^8 ms^{-1}
Planck's constant = 6.626×10^{-34} Js
Charge of electron = 1.6×10^{-19} JeV^{-1})
(1) 0.9 eV
(2) 4.0 eV
(3) 2.1 eV
(4) 3.1 eV

Ans. (3)

Sol. $h\nu = \phi + h\nu^{\circ}$

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

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

$$\phi=\frac{6.626\times10^{-34}\times3\times10^{8}}{4000\times10^{-10}}-\frac{1}{2}\times9\times10^{-31}\times(6\times10^{5})^2$$

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

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

(1) Lysine
(2) Asparagine
(3) Serine
(4) Histidine

Ans. (4)

Sol. Histidine

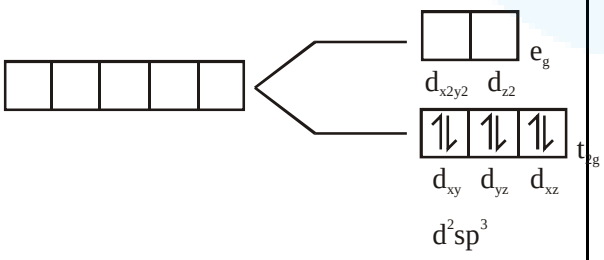
22. The metal d-orbitals that are directly facing the ligands in $K_3[Co(CN)_6]$ are :

(1) d_{xz}, d_{yz} and d_{z^2}
(2) d_{xy}, d_{xz} and d_{yz}
(3) d_{xy} and $d_{x^2-y^2}$
(4) $d_{x^2-y^2}$ and d_{z^2}

Ans. (4)

Sol. $K_3[Co(CN)_6]$

$Co^{+3} \rightarrow [Ar]_{18}\ 3d^6$



d^2sp^3

23. The hardness of a water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3} M $CaSO_4$ is :

(molar mass of $CaSO_4$ = 136 g mol^{-1})

(1) 100 ppm
(2) 50 ppm
(3) 10 ppm
(4) 90 ppm

Ans. (1)

Sol. ppm of $CaCO_3$

$(10^{-3} \times 10^{3}) \times 100 = 100$ ppm

24. The correct order for acid strength of compounds $CH{\equiv}CH$, $CH_3{-}C{\equiv}CH$ and $CH_2{=}CH_2$ is as follows :

(1) $CH \equiv CH > CH_2 = CH_2 > CH_3{-}C \equiv CH$
(2) $HC \equiv CH > CH_3 - C \equiv CH > CH_2 = CH_2$
(3) $CH_3{-}C \equiv CH > CH_2 = CH_2 > HC \equiv CH$
(4) $CH_3{-}C \equiv CH > CH \equiv CH > CH_2 = CH_2$

Ans. (2)

Sol. $CH{\equiv}CH > CH_3{-}C{\equiv}CH > CH_2{=}CH_2$

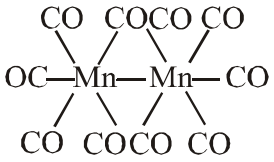
(Acidic strength order)

25. $Mn_2(CO)_{10}$ is an organometallic compound due to the presence of :

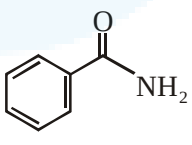
(1) Mn – Mn bond (2) Mn – C bond
(3) Mn – O bond (4) C – O bond

Ans. (2)

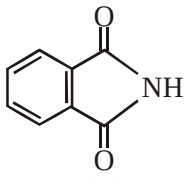
Sol. Compounds having at least one bond between carbon and metal are known as organometallic compounds.



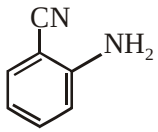
26. The increasing order of reactivity of the following compounds towards reaction with alkyl halides directly is :



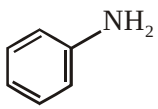
(A)



(B)



(C)

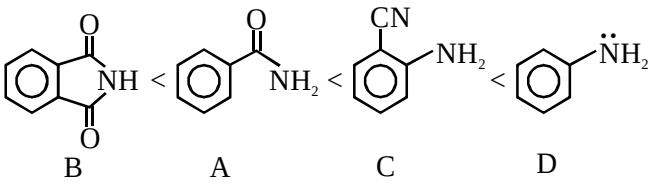


(D)

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

Ans. (2)

Sol. Nucleophilicity order



B A C D

27. The pair of metal ions that can give a spinonly magnetic moment of 3.9 BM for the complex $[M(H_2O)_6]Cl_2$, is :

(1) Cr^{2+} and Mn^{2+} (2) V^{2+} and Co^{2+}

(3) V^{2+} and Fe^{2+} (4) Co^{2+} and Fe^{2+}

Ans. (2)

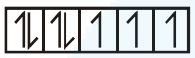
27. Ans.(2) V^{2+} and Co^{2+}

Sol. $V^{2+} \rightarrow [V(H_2O)_6]Cl_2$; $[Ar]_{18}$ 

$3d^3$

3 unpaired e^-, spin only magnetic moment

= 3.89 B.M.

$Co^{2+} \rightarrow [Co(H_2O)_6]Cl_2$; $[Ar]_{18}$ 

$3d^7$

3 unpaired e^-, spin only magnetic moment

= 3.89 B.M.

28. In the following reaction

Aldehyde + Alcohol $\xrightarrow{HCl}$ Acetal

Aldehyde	Alcohol
HCHO	^{t}BuOH
CH_3CHO	MeOH

The best combinations is :

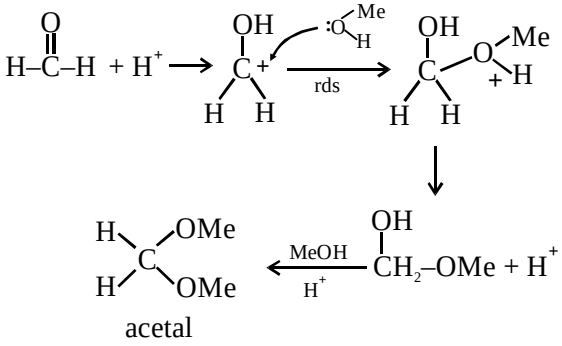
(1) HCHO and MeOH

(2) HCHO and ^{t}BuOH

(3) CH_3CHO and MeOH

(4) CH_3CHO and ^{t}BuOH

Ans. (1)

Sol. 

acetal

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

t-butanol can show formation of carbocation in acidic medium.

29. 50 mL of 0.5 M oxalic acid is needed to neutralize 25 mL of sodium hydroxide solution. The amount of NaOH in 50 mL of the given sodium hydroxide solution is :

(1) 40 g (2) 20 g (3) 80 g (4) 10 g

BONUS

$H_2C_2O_4 + 2NaOH \longrightarrow Na_2C_2O_4 + 2H_2O$

m_{eq} of $H_2C_2O_4$ = m_{eq} NaOH

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

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

Now 1000 ml solution = 2 × 40 gram NaOH

$\therefore$ 50 ml solution = 4 gram NaOH

30. A metal on combustion in excess air forms X, X upon hydrolysis with water yields H_2O_2 and O_2 along with another product. The metal is :

(1) Rb (2) Na (3) Mg (4) Li

Ans. (1)

Sol. $Rb + O_{2(excess)} \longrightarrow RbO_2$

$2RbO_2 + 2H_2O \longrightarrow 2RbOH + H_2O_2 + O_2$