FINAL JEE–MAIN EXAMINATION – APRIL, 2023
Held On Saturday 08th April, 2023
TIME : 09:00 AM to 12:00 PM

SECTION - A

61. The reaction

$\frac{1}{2}H_2(g)+Ag(Cl)(s) \rightleftharpoons H^+(aq)+Cl^-(aq)+Ag(s)$

occurs in which of the given galvanic cell.

(1) Pt | $H_2(g)$ | HCl(sol^n) | $AgNO_3$(sol^n) | Ag
(2) Pt | $H_2(g)$ | HCl(sol^n) | AgCl(s) | Ag
(3) Pt | $H_2(g)$ | KCl(sol^n) | AgCl(s) | Ag
(4) Ag | AgCl(s) | KCl(sol^n) | $AgNO_3$ | Ag

Sol. **2**

Anode $\rightarrow H_2 \rightarrow 2H^+ + 2e^-$

Cathode $\rightarrow AgCl + e^- \rightarrow Ag + Cl^-$

62. Sulphur (S) containing amino acids from the following are:

(a) isoleucine (b) cysteine (c) lysine (d) methionine
(e) glutamic acid

(1) b, c, e (2) a, d (3) a, b, c (4) b, d

Sol. **4**

(a) isoleucine : $CH_3-CH_2-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{NH_2}{|}}{CH}-COOH$

(b) cysteine : $HS-CH_2-\underset{\underset{NH_2}{|}}{CH}-COOH$

(c) lysine : $H_2N-(CH_2)_4-\underset{\underset{NH_2}{|}}{CH}-COOH$

(d) methionine : $CH_3-S-CH_2-CH_2-\underset{\underset{NH_2}{|}}{CH}-COOH$

(e) glutamic acid : $HOOC-CH_2-CH_2-\underset{\underset{NH_2}{|}}{CH}-COOH$

63. Which of the following complex is octahedral, diamagnetic and the most stable?

(1) $K_3[Co(CN)_6]$ (2) $[Ni(NH_3)_6]Cl_2$ (3) $[Co(H_2O)_6]Cl_2$ (4) $Na_3[CoCl_6]$

Sol. **1**

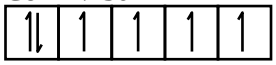
$K_3[Co(CN)_6]$

$+3 + x - 6 = 0$

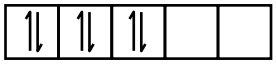
$\boxed{x = +3}$

$\Downarrow$

$Co^{+3} \rightarrow 3d^6$



$\because CN^-$ is SFL so pairing occur so



u-e = 0

$\downarrow$

So diamagnetic

64. Which of the following metals can be extracted through alkali leaching technique?

(1) Cu (2) Au (3) Pb (4) Sn

Sol. **4**

Sn due to Amphoteric nature.

65. The correct order of spin only magnetic moments for the following complex ions is

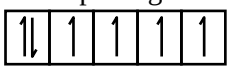
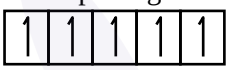
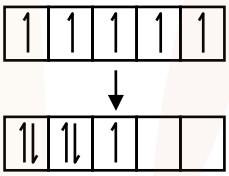
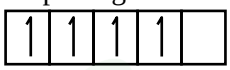
(1) $[CoF_6]^{3-}<[MnBr_4]^{2-}<[Fe(CN)_6]^{3-}<[Mn(CN)_6]^{3-}$

(2) $[Fe(CN)_6]^{3-}<[CoF_6]^{3-}<[MnBr_4]^{2-}<[Mn(CN)_6]^{3-}$

(3) $[MnBr_4]^{2-}<[CoF_6]^{3-}<[Fe(CN)_6]^{3-}<[Mn(CN)_6]^{3-}$

(4) $[Fe(CN)_6]^{3-}<[Mn(CN)_6]^{3-}<[CoF_6]^{3-}<[MnBr_4]^{2-}$

Sol. **4**

$[CoF_6]^{3-}$	$[MnBr_4]^{2-}$	$[Fe(CN)_6]^{3-}$	$[Mn(CN)_6]^{3-}$
↓	↓	↓	↓
CO^{+3}	Mn^{+2}	$3d^5$	Mn^{+3}
F^- WFL	Br^- WFL	CM^- SFL	CN^- is SFL
So no pairing	So no pairing	Pairing occur	So pairing occur
			
u.e. = 4	u.e. = 5	u.e. = 1	u.e. = 2

$[Fe(CN)_6]^{-3} < [Mn(CN)_6]^{-3} < [CoF_6]^{-3} < [MnBr_4]^{-2}$

66. The water gas on reacting with cobalt as a catalyst forms

(1) Methanoic acid (2) Methanal (3) Ethanol (4) Methanol

Sol. **4**

$$(CO + H_2) + H_2 \xrightarrow[ZnO,\ Cr_2O_3]{700K} CH_3OH$$

↓

Catalyst

67. $2IO_3^- + xI^- + 12H^+ \rightarrow 6I_2 + 6H_2O$

What is the value of x?

(1) 12 (2) 10 (3) 2 (4) 6

Sol. **2**

n factor of IO_3^- and I^- in the given redox reaction are 5 and 1 respectively. Therefore, IO_3^- will always react in the molar ratio 1 : 5 to get I_2.

$IO_3^- + 6H^+ + 5I^- \rightarrow 3I_2 + 3H_2O$

To get 6 molar I_2, multiple equation by 2

$2IO_3^- + 12H^+ + 10I^- \rightarrow 6I_2 + 6H_2O$

So, x = 10

68. What is the purpose of adding gypsum to cement?

(1) To give a hard mass (2) To speed up the process of setting

(3) To facilitate the hydration of cement (4) To slow down the process of setting

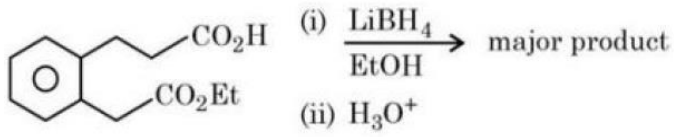
Sol. **4**

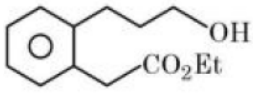
$CaSO_4 \cdot 2H_2O$ Gypsum

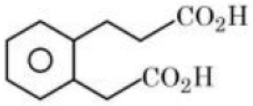
To slow down the process of setting.

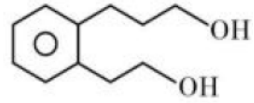
Gypsum is added to control the 'setting of cement'. If not added, the cement will set immediately after miximg of water leaving no time the concrete placing.

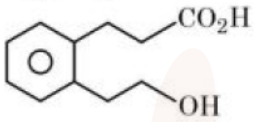
69. The major product formed in the following reaction is:



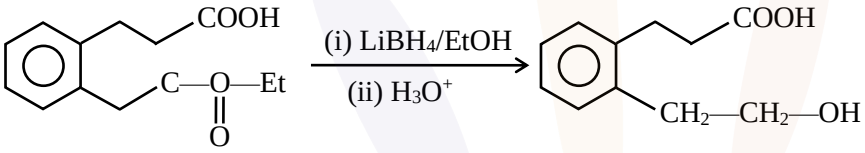
(1) 

(2) 

(3) 

(4) 

Sol. **4**



Note: Lithium borohydride is commonly used for selective reduction of esters and lactones to the corresponding alcohol.

70. Match list I with list II:

List I (species)	**List II (Maximum allowed concentration in ppm in drinking water)**
A. F^-	I. < 50 ppm
B. SO_4^{2-}	II. < 5 ppm
C. NO_3^-	III. < 2 ppm
D. Zn	IV. < 500 ppm

(1) A-III, B-II, C-I, D-IV
(2) A-II, B-I, C-III, D-IV
(3) A-IV, B-III, C-II, D-I
(4) A-I, B-II, C-III, D-IV

Sol. **Bouns**
Data based

	Maximum allowed (ppm)
F^-	< 2 ppm
SO_4^{2-}	< 5 ppm
NO_3^-	< 50 ppm
Zn	< 500 ppm

71. In chromyl chloride, the number of d-electrons present on chromium is same as in (Given at no. of Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26)
(1) Fe (III) (2) V (IV) (3) Ti (III) (4) Mn (VII)

Sol. **4**

$CrO_2Cl_2 \rightarrow$ Chromyl chloride

$\Downarrow$

$Cr^{+6} \rightarrow 4s^0\ 3d^0$

$Mn(vii) \rightarrow Mn^{+7}$ — Same

$\Downarrow$

$4s^0\ 3d^0$

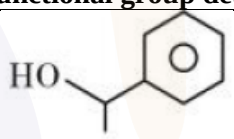
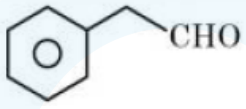
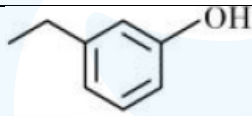
72. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Butan-1-ol has higher boiling point than ethoxyethane.
Reason R : Extensive hydrogen bonding leads to stronger association of molecules.
In the light of the above statements, choose the correct answer from the options given below:
(1) Both A and R are true but R is not the correct explanation of A
(2) Both A and R are true and R is the correct explanation of A
(3) A is false but R is true
(4) A is true but R is false

Sol. **2**

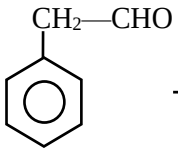
At comparable molecular mass, alcohol has higher b.p. than ether due to H-bond, because H-bond leads to stronger associated of molecules.

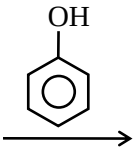
73. Match List I with List II:

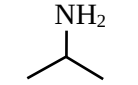
List I (Reagents used)	**List II (Compound with Functional group detected)**
A. Alkaline solution of copper sulphate and sodium cirate	I. 
B. Neutral $FeCl_3$ solution	II. 
C. Alkaline chloroform solution	III. 
D. Potassium iodide and sodium hypochlorite	IV. 

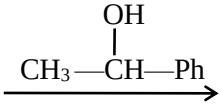
Choose the correct answer from the options given below:
(1) A-III, B-IV, C-II, D-I
(2) A-II, B-IV, C-III, D-I
(3) A-IV, B-I, C-II, D-III
(4) A-III, B-IV, C-I, D-II

Sol. **1**

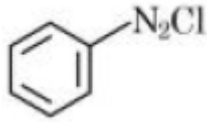
(A)  Alkaline solution of copper Sulphate and sodium citrate → Red PPt

(B)  Neutral $FeCl_3$ → Voilet colour

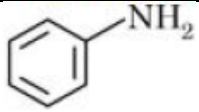
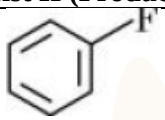
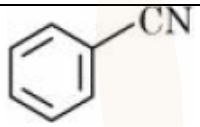
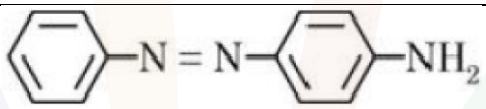
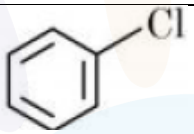
(C) Alkaline chloroform solution  → Carbyl amine reaction

(D) $KI + \overset{+}{N}aOCl$  → Haloform reaction

74. Match List I with List II:



is reacted with reagents in List I to form products in List II.

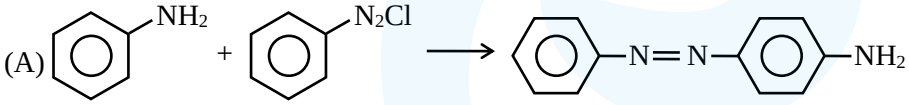
List I (Reagent)	List II (Product)
A. 	I. 
B. HBF_4, Δ	II. 
C. Cu, HCl	III. 
D. CuCN/KCN	IV. 

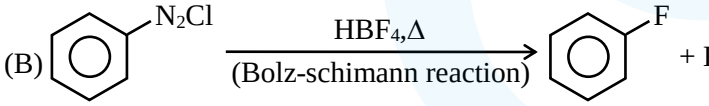
Choose the correct answer from the options given below:

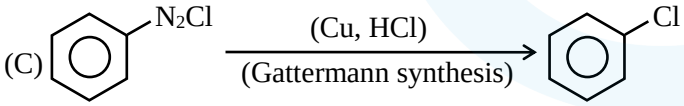
(1) A-I, B-III, C-IV, D-II (2) A-III, B-I, C-II, D-IV

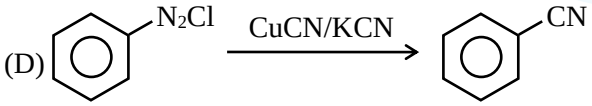
(3) A-III, B-I, C-IV, D-II (4) A-IV, B-III, C-II, D-I

Sol. **3**

(A) 

(B) 

(C) 

(D) 

75. Match List I with List II:

List I	List II
A. Saccharin	I. High potency sweetener
B. Aspartame	II. First artificial sweetening agent
C. Alitame	III. Stable at cooking temperature
D. Sucralose	IV. Unstable at cooking temperature

Choose the **correct** answer from the options given below:

(1) A-II, B-III, C-IV, D-I (2) A-II, B-IV, C-I, D-III

(3) A-IV, B-III, C-I, D-II (4) A-II, B-IV, C-III, D-I

Sol. **2**

(A) Saccharin → First artificial sweetening agent

(B) Aspartame → Unstable at cooking temperature used in soft drink and cold drink.

(C) Alitame → High potency sweetener (2000 more sweeter than cane sugar)

(D) Sucralose → Stable at coocking temperature. Also it does not provide calories.

76. The correct order of electronegativity for given elements is:

(1) P > Br > C > At (2) C > P > At > Br (3) Br > P > At > C (4) Br > C > At > P

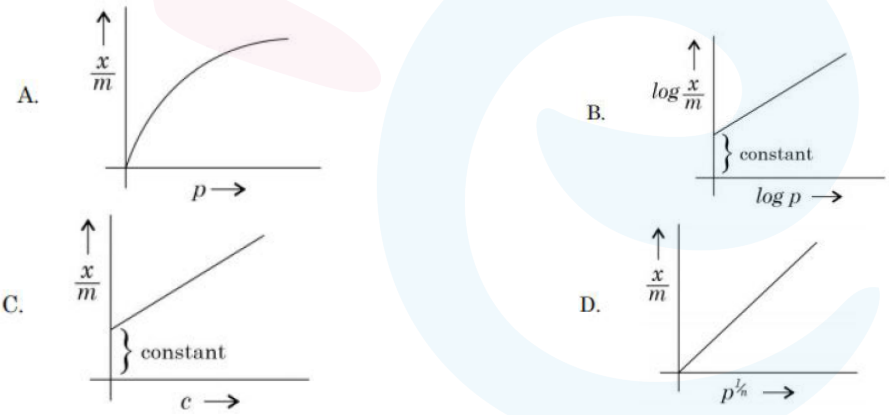
Sol. **4**

C (2.5)
P (2.1) $\Rightarrow$ Br > C > At > P
Br (2.8)
At (2.2)

77. Given below are two statements :
Statement I : Lithium and Magnesium do not form superoxide
Statement II : The ionic radius of Li^+ is larger than ionic radius of Mg^{2+}
In the light of the above statements, choose the **most appropriate** answer from the options given **below**:
(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both statement I and Statement II are correct
(4) Both statement I and Statement II are incorrect

Sol. **3 (Fact-based)**
Due to small in size Li and Mg do not from superoxide.
$Li^+ \geq Mg^{+2}$ - radius
$2e^-$ $10e^-$
↓
Due to diagonal relationship.

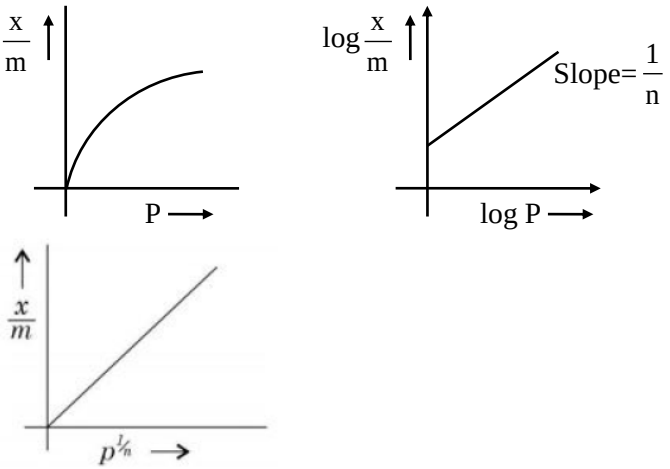
78. Which of the following represent the Freundlich adsorption isotherms?



Choose the correct answer from the options given below:
(1) A, C, D only (2) A, B only (3) A, B, D only (4) B, C, D only

Sol. **3**

$\frac{x}{m} = Kp^{1/n}$ $\log\frac{x}{m} = \log K + \frac{1}{n}\log P$



79. Which halogen is known to cause the reaction given below:

$2Cu^{2+} + 4X^- \rightarrow Cu_2X_2(s) + X_2$

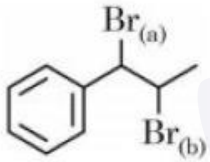
(1) All halogens (2) Only chlorine (3) Only Bromine (4) Only Iodine

Sol. **4**

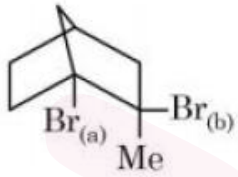
(Only iodine)

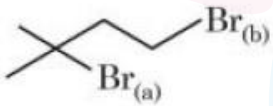
$2Cu^{2+} + 4I^- \rightarrow Cu_2I_2 + I_2$

80. Choose the halogen which is most reactive towards S_N1 reaction in the given compounds (A, B, C, & D)

A. 

B. 

C. 

D. 

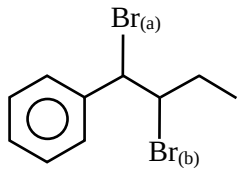
(1) A-$Br_{(a)}$; B-$I_{(a)}$; C-$Br_{(b)}$; D-$Br_{(a)}$

(2) A-$Br_{(b)}$; B-$I_{(a)}$; C-$Br_{(a)}$; D-$Br_{(a)}$

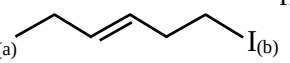
(3) A-$Br_{(b)}$; B-$I_{(b)}$; C-$Br_{(b)}$; D-$Br_{(b)}$

(4) A-$Br_{(a)}$; B-$I_{(a)}$; C-$Br_{(a)}$; D-$Br_{(a)}$

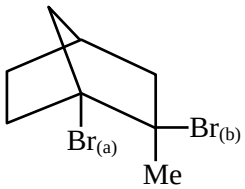
Sol. **1**

(A) 

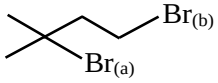
→ Because formed intermediate carbocation formed by $Br_{(a)}$ get stabilised by conjugation with phenyl ring

(B) 

→ Because the intermediate carbocation formed by $I_{(a)}$ become more stable by conjugation

(C) 

→ Becouse, we con't remove $Br_{(a)}$ from bridge head carbon (Bredt's rule)

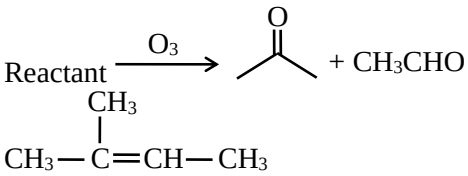
(D) 

→ Becouse, formed intermediate by $Br_{(a)}$, 3^o carbocation is more stable (stability of carbocation $3^o > 2^o > 1^o$)

SECTION - B

81. Molar mass of the hydrocarbon (X) which on ozonolysis consumes one mole of O_3 per mole of (X) and gives one mole each of ethanol and propanone is _____g mol^{-1} (Molar mass of C : 12 g mol^{-1}, H : 1 $gmol^{-1}$)

Sol. **70**



(C_5H_{10})

Molecular Mass = 70

82. XeF_4 reacts with SbF_5 to form

$[XeFm]^{n+}$ $[SbF_y]^{z-}$

m+n+y+z =_____

Sol. **11**

$XeF_4 + SbF_5 \rightarrow [XeF_3]^+ (SbF_6)^-$

m + n + x + y = 3 + 1 + 6 + 1 = 11

Xenon fluoride act as F^- donor and F^- acceptor.

83. The number of following statements which is/are incorrect is_____

(1) Line emission spectra are used to study the electronic structure

(2) The emission spectra of atoms in the gas phase show a continuous spread of wavelength from red to violet

(3) An absorption spectrum is like the photographic negative of an emission spectrum

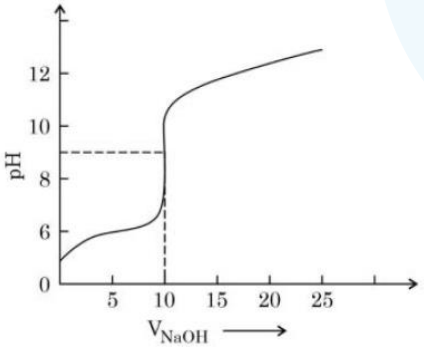
(4) The element helium was discovered in the sun by spectroscopic method

Sol. **1**

Fact

84. The titration curve of weak acid vs. strong base with phenolphthalein as indictor) is shown below. The $K_{phenolphthalein} = 4\times10^{-10}$

Given : log 2 = 0.3



The number of following statements/s which is/are correct about phenolphthalein is_____

(1) It can be used as an indicator for the titration of weak acid with weak base.

(2) It begins to change colour at pH = 8.4

(3) It is a weak organic base

(4) It is colourless in acidic medium

Sol. **2**

(B) $pk_n = -\log(4\times10^{-10}) = 9.4$

Indicator range

$\Rightarrow$ $pk_{In} \pm 1$

i.e. 8.4 to 10.4

(D) In acidic medium, phenolphthalein is in unionized form and is colourless.

85. When a 60 W electric heater is immersed in a gas for 100s in a constant volume container with adiabatic walls, the temperature of the gas rises by 5°C. The heat capacity of the given gas is_____ $J\ K^{-1}$ (Nearest integer)

Sol. **1200**

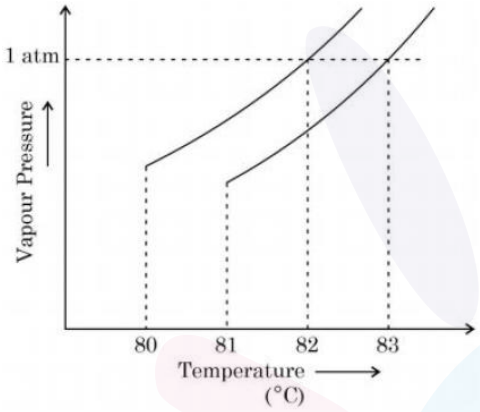
Adiabatic wall {no heat exchange between system and surrounding}

$C_v \times \Delta T = P \times t/sec$

$C_v \times 5 = 60 \times 100$

$C_v = 1200$

86. The vapour pressure vs. temperature curve for a solution solvent system is shown below:



The boiling point of the solvent is_____°C

Sol. **82**

Boiling point of solvent is 82°C

Boiling point of solvent is 83°C

87. 0.5 g of an organic compound (X) with 60% carbon will produce_____$\times 10^{-1}$ g of CO_2 on complete combustion.

Sol. **11**

$$\text{Moles of carbon} = \frac{0.5 \times 0.6}{12}$$

$$\text{Moles of } CO_2 = \frac{0.5 \times 0.6}{12}$$

$$\text{Mass of } CO_2 = \frac{0.5 \times 0.6}{12} \times 44 = 11 \times 10^{-1} \text{gram}$$

88. The number of following factors which affect the percent covalent character of the ionic bond is_____

(1) Polarising power of cation (2) Extent of distortion of anion

(3) Polarisability of the anion (4) Polarising power of anion

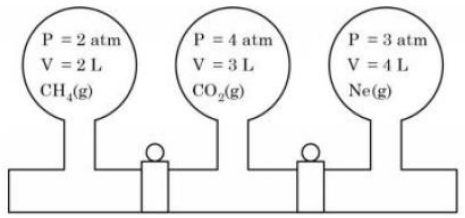
Sol. **3**

Percent covalent character of the ionic bond

(1) Polarising power of cation (2) Extent of distortion of anion

(3) Polarisability of the anion

89.



Three bulbs are filled with CH_4, CO_2 and Ne as shown the picture. The bulbs are connected through pipes of zero volume. When the stopcocks are opened and the temperature is kept constant throughout, the pressure of the system is found to be_____atm. (Nearest integer)

Sol. **3**

$P_f V_f = P_1 V_1 + P_2 V_2 + P_3 V_3$

$P_f \times 9 = 2 \times 2 + 4 \times 3 + 3 \times 4$

$$P_f = \frac{28}{9} = 3.11 \simeq 3$$

90. The number of given statements/s which is/are correct is_____

(1) The stronger the temperature dependence of the rate constant, the higher is the activation energy.

(2) If a reaction has zero activation energy, its rate is independent of temperature.

(3) The stronger the temperature dependence of the rate constant, the smaller is the activation energy

(4) If there is no correlation between the temperature and the rate constant then it means that the reaction has negative activation energy.

Sol. **2**

Clearly, if $E_a = 0$, K is temperature independent

if $E_a > 0$, K increase with increase in temperature

if $E_a < 0$, K decrease with increase in temperature