the given reaction, the correct reagent is :

(A) ○ $NaBH_4$

(B) ○ **$NaBH_4$/$CeCl_3$ (Correct Answer)**

(C) ○ $LiAlH_4$

(D) ○ DIBAL - H

(E) ○ H_2/Pd

Question No.2 (Question Id - 8)

For 'n' moles of a 'Van der waals' gas having the equation of state

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

$\left(\frac{\partial U}{\partial V}\right)_T$ is equal to :

[U is the internal energy]

(A) ○ $\dfrac{nRT}{V - nb}$

(B) ○ $\left(\dfrac{n^2}{V^2} a\right)\left(\dfrac{RT}{V - nb}\right)$

(C) ○ $\boxed{\dfrac{n^2 a}{V^2}}$ **(Correct Answer)**

(D) ○ $\dfrac{2nRT}{V - nb} + \dfrac{n^2 a}{V^2}$

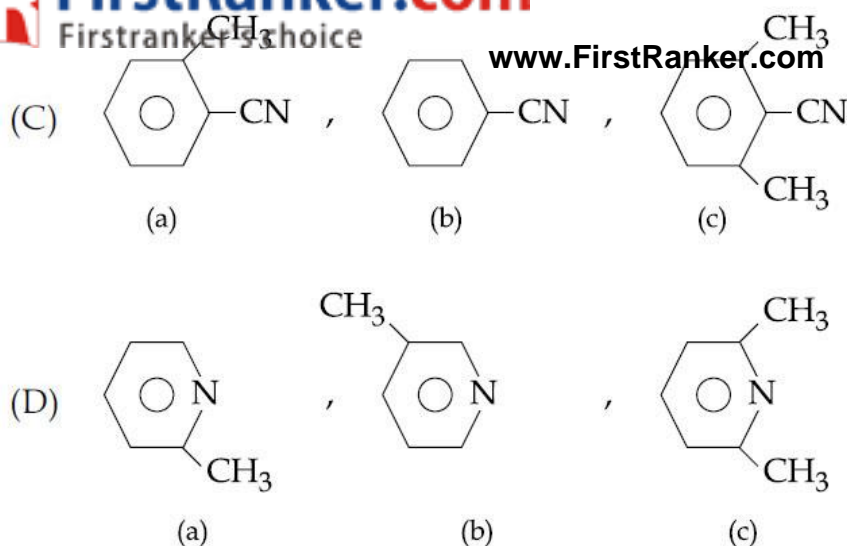(E) ○ $\dfrac{nR}{V - nb}$

Question No.3 (Question Id - 6)

For an ideal gas (PV = nRT)

$\left(\dfrac{\partial^2 P}{\partial V \partial T}\right)_n$ is equal to :

(A) ○ $-\dfrac{nRT}{V^2}$

(B) ○ $\boxed{-\dfrac{nR}{V^2}}$ **(Correct Answer)**

(C) ○ $\dfrac{nRV}{T}$

(D) ○ $\dfrac{nV^2}{RT}$

(E) ○ $-\dfrac{nRT^2}{V}$

Question No.4 (Question Id - 37)

(C)

(a)   (b)   (c)

(D)

(a)   (b)   (c)

In your opinion, which of the following answer set is correct for most spontaneous reaction ?

(A) ○ A(c), B(b), C(b), D(c)
(B) ○ A(a), B(b), C(c), D(b)
(C) ○ A(a), B(a), C(b), D(a)
(D) ○ **A(a), B(a), C(c), D(b) (Correct Answer)**
(E) ○ A(b), B(c), C(a), D(c)

Question No.5 (Question Id - 49)

The O - O stretching vibration in oxyhemoglobin is :

(A) ○ Higher than O - O stretching vibration of molecular oxygen
(B) ○ **Lower than O - O stretching vibration of molecular oxygen (Correct Answer)**
(C) ○ Equal to the O - O stretching vibration of molecular oxygen
(D) ○ Very close to the O - O stretching vibration of hemocyanin
(E) ○ Close to the O - O stretching vibration of Na_2O_2

Question No.6 (Question Id - 25)
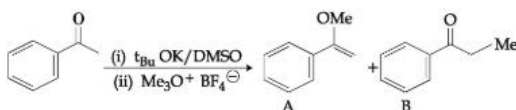
In the following given reaction, the product distribution will be :

(A) ○ Only A
(B) ○ Only B
(C) ○ **A is major and B is minor (~A>B) (Correct Answer)**
(D) ○ B is major and A is minor (~B>A)
(E) ○ A and B formed equally (A = B)

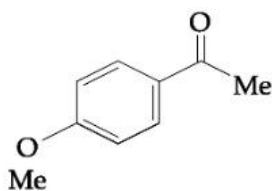
Question No.7 (Question Id - 45)

The color of Ruby(Al_2O_3 contains 0.2 - 1 atom% of Cr^{3+}) and potassium permanganate are because of :

(A) ○ **d - d transition and ligand-to-metal charge-transfer transition, respectively**

   (Correct Answer)
(B) ○ ligand-to-metal charge-transfer and d-d transition, respectively
(C) ○ d - d transition and d - d transition, respectively
(D) ○ Ligand-to-metal charge-transfer and ligand-to-metal charge transfer transition, respectively

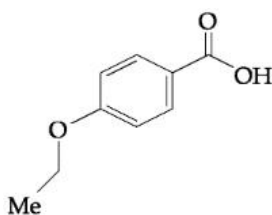(E) ○ Metal-to-ligand charge-transfer and ligand-to-metal charge-transfer, transition, respectively

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Question No.8 (Question Id - 31)

The ^{13}C NMR spectrum for the following compound contains these peaks : 17.3, 61.1, 100 - 150 ppm(four peaks) and 166.8 ppm. The compound will be :
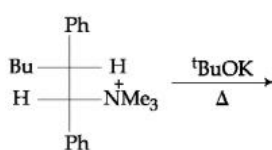
(D) ○

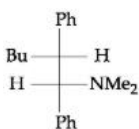(E) ○
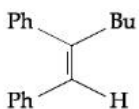

Question No.9 (Question Id - 18)
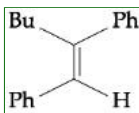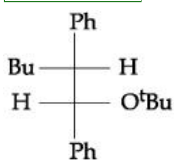
Identify the major product :

(A) ○

(B) ○

(C) ○
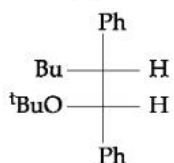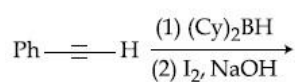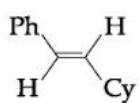
 (Correct Answer)

(D) ○

(E) ○

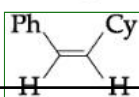
Question No.10 (Question Id - 29)

Identify the major product :


(A) ○

(B) ○

(C) ○

 (Correct Answer)

(D) ○

- $\Delta S_{surr} < 0$
- $\Delta H_{mix} = 0$
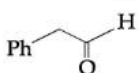
Question No.12 (Question Id - 16)

The rotational constant and interatomic distance of HF are given by 4.1×10^{-22} J and 92 pm, respectively. The moment of inertia of the molecule is calculated as :

(A) ○ 4.20×10^{-47} kgm^2

(B) ○ 2.81×10^{-46} kgm^2

(C) ○ **1.36×10^{-47} kgm^2 (Correct Answer)**

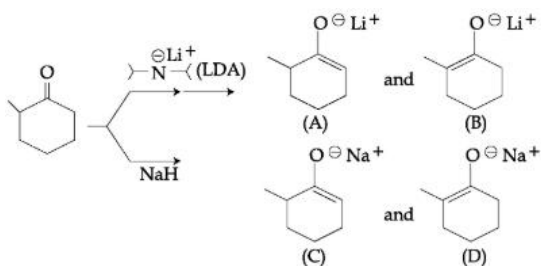(D) ○ 2.81×10^{-47} kgm^2

(E) ○ 3.47×10^{-46} kgm^2

Question No.13 (Question Id - 20)

$A = $ [cyclopentane structure], $B = nBuLi$, $C = PPh_3$

$D = PhCHO$
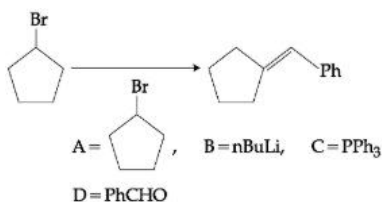
For the conversion of the given reaction, the following reagents are used in which sequence ?

(A) ○ $A \rightarrow B \rightarrow C \rightarrow D$

(B) ○ **$A \rightarrow C \rightarrow B \rightarrow D$ (Correct Answer)**

(C) ○ $A \rightarrow D \rightarrow B \rightarrow C$

(D) ○ $A \rightarrow C \rightarrow D \rightarrow B$

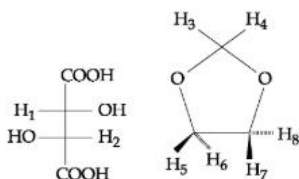(E) ○ $A \rightarrow B \rightarrow D \rightarrow C$

Question No.14 (Question Id - 26)

For the two sets of given reactions, what will be the correct combination of enolate intermediates ?

(A) ○ (A), (C)

(B) ○ **(A), (D) (Correct Answer)**

(C) ○ (B), (C)

(D) ○ (B), (D)

(E) ○ (A), (B), (C), (D)

Question No.15 (Question Id - 19)

Identify the marked hydrogen atoms as heterotopic or homotopic in the following molecules. What will be the correct answer for the given pair of hydrogens :
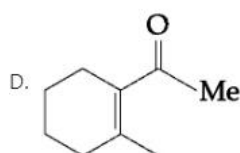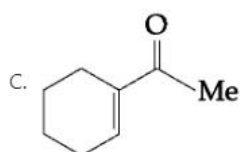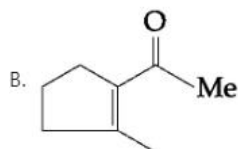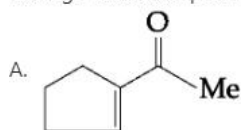
H_1 & H_2; H_3 & H_4; H_5 & H_6 ?

(A) ○ All are hototopic

(B) ○ Homotopic; Heterotopic; Heterotopic

(C) ○ Heterotopic; Homotopic; Heterotopic

(E) ○ $\dfrac{p+q}{2}$

Question No.17 (Question Id - 32)

Arrange these compounds in descending order of their λ_{max}.

A.

B.

C.

D.

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

(A) ○ C > D > B > A

(B) ○ **B > D > A > C (Correct Answer)**

(C) ○ A > B > C > D

(D) ○ A > C > B > D

(E) ○ B > D > C > A

Question No.18 (Question Id - 2)

Find the angle between the two vectors, $\vec{A}=3\hat{i}-2\hat{j}+\sqrt{3}\hat{k}$ and $\vec{B}=5\hat{i}+3\hat{j}+\sqrt{2}\hat{k}$.

(A) ○ 45°

(B) ○ 10°

(C) ○ **62° (Correct Answer)**

(D) ○ 28°

(E) ○ 76°

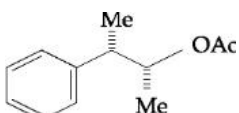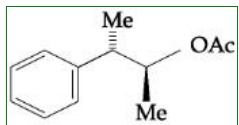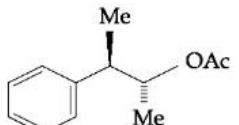**Question No.19 (Question Id - 41)**
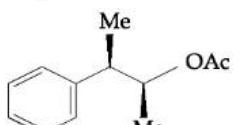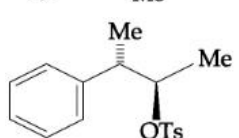
Some physical properties of chemical compounds are mentioned as follows :

A. Thermally most stable	B. Highest proton affinity	C. Highest solubility in water
(a) PH_4Cl	(a) Me_3N	(a) AgF
(b) PH_4Br	(b) Ph_3N	(b) $AgBr$
(c) PH_4I	(c) $N{-}(\bigcirc{-}OMe)_3$	(c) AgI

Which of the following answer set is correct corresponding to the properties mentioned above ?

(A) ○ **A(c), B(a), C(a) (Correct Answer)**

(B) ○ A(a), B(a), C(c)

(C) ○ A(c), B(c), C(a)

(D) ○ A(a), B(c), C(a)

(E) ○ A(c), B(c), C(c)

Me
OTs
Firstranker's choice
$\xrightarrow{AcOH}$ A
Me

(A) ○
Me
OAc
Me

(B) ○
Me
OAc (Correct Answer)
Me

(C) ○
Me
OAc
Me

(D) ○
Me
OAc
Me

(E) ○
Me
Me
OTs

Question No.22 (Question Id - 12)
Which of the following statements about the temperature dependence of reaction rates is correct ?

(A) ○ The slope of the plot of ln k against $\frac{1}{T}$ is always independent of the activation energy of the reaction.

(B) ○ Activation energy is the maximum energy that reactants must have in order to form products.

(C) ○ Reactions of the same order must have the same activation energy.

(D) ○ **Stronger dependence of reaction rate on temperature leads to higher activation energy.**
     (Correct Answer)

(E) ○ Temperature dependence of reaction rates always has to follow the 'Linear' behaviour.

Question No.23 (Question Id - 7)
For a cubic crystal if the relationship between the lattice distance (d) and the wavelength (λ) of X-ray is represented as d = 4.85λ, then the difference between the angles of first and third order diffraction from the crystal would be :

(A) ○ 9.70°
(B) ○ 5.95°
(C) ○ 30.72°
(D) ○ **12.10° (Correct Answer)**
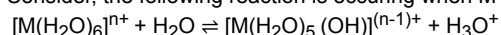(E) ○ 18.02°

Question No.24 (Question Id - 38)
Consider, the following reaction is occuring when M = Fe^{2+}, Fe^{3+}, Cr^{3+} and Ni^{2+}.
$[M(H_2O)_6]^{n+} + H_2O \rightleftharpoons [M(H_2O)_5 (OH)]^{(n-1)+} + H_3O^+$
Which of the following answer is correct for the increasing order of pK_a values of different metal ions ?

(A) ○ $Fe^{2+} < Ni^{2+} < Cr^{3+} < Fe^{3+}$
(B) ○ $Cr^{3+} < Fe^{3+} < Fe^{2+} < Ni^{2+}$
(C) ○ **$Fe^{3+} < Cr^{3+} < Ni^{2+} < Fe^{2+}$ (Correct Answer)**
(D) ○ $Cr^{3+} < Fe^{3+} < Ni^{2+} < Fe^{2+}$
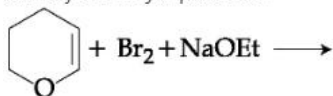(E) ○ $Fe^{2+} < Fe^{3+} < Ni^{2+} < Cr^{3+}$

estion No.26 (Question Id - 5)

From the graph below, the correct order of the real gases with increasing value of the Van der waal's constant 'a' is :
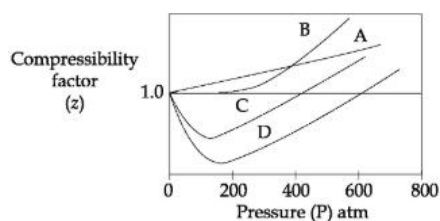
(A) ○ B < A < C < D

(B) ○ A < C < D < B

(C) ○ **A < B < C < D (Correct Answer)**

(D) ○ B < D < C < A

(E) ○ C < D < A < B

Question No.27 (Question Id - 21)

Identify the major product :
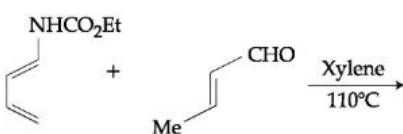

(A) ○ **(Correct Answer)**

(B) ○

(C) ○

(D) ○

(E) ○

Question No.28 (Question Id - 47)

A researcher has measured the room temperature magnetic moments of $Na_2[PdCl_4]$ and $[Fe(H_2O)_6](ClO_4)_2$. In your opinion, which of the following set of answers fits well with your expectation ?
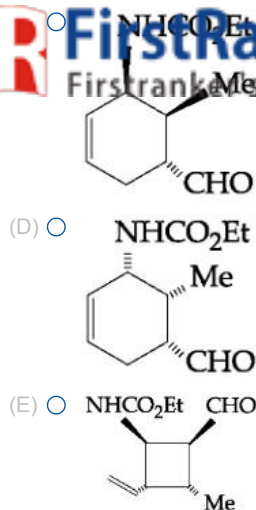
(A) ○ **0 and 5.1μ_B, respectively (Correct Answer)**

(B) ○ 2.9 μ_B and 0, respectively

(C) ○ 0 and 4.7μ_B, respectively

(D) ○ 2.83μ_B and 4.90μ_B, respectively

(E) ○ 0 and 0, respectively

Question No.29 (Question Id - 23)

Draw the major product :

(A) ○

(D) ○

(E) ○

Question No.30 (Question Id - 4)

The de-Broglie wavelength associated with an electron in the first Bohr orbit of hydrogen atom is :

(A) ○ 5.30 pm
(B) ○ **332 pm (Correct Answer)**
(C) ○ 3.30 nm
(D) ○ 5.32 nm
(E) ○ 727 pm

Question No.31 (Question Id - 44)

Categorize the following compounds according to the increasing order of C - O bond distances :
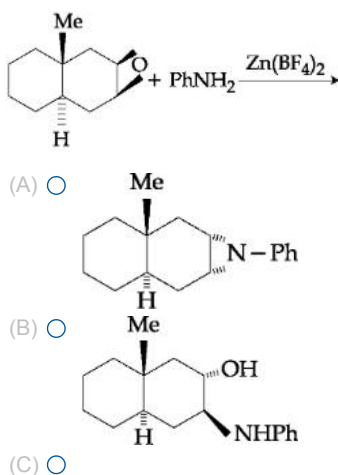
A. $[V(CO)_6]^-$

B. $[Fe(CO)_6]^{2+}$

C. $[Mn(CO)_6]^+$

D. $[Cr(CO)_6]$

E. $[Fe(CO)_4]^{2-}$

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

(A) ○ **B < C < D < A < E (Correct Answer)**
(B) ○ A < E < D < C < B
(C) ○ E < A < D < C < B
(D) ○ B < C < E < D < A
(E) ○ E < A < D < B < C

Question No.32 (Question Id - 24)

Predict the major product :

(A) ○

(B) ○

(C) ○

Question No.33 (Question Id - 40)

Calculate the EMF for the following reaction at 25°C.

$Mg + Fe^{2+}(1\ M) \rightleftharpoons Mg^{2+}(0.1\ M) + Fe$
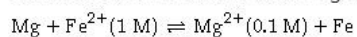
where, $E^o_{Mg^{2+}/Mg} = -2.63\ V$, $E^o_{Fe^{2+}/Fe} = -0.441\ V$

ANSWER :

(A) ○ 2.25 V
(B) ○ **2.21 V (Correct Answer)**
(C) ○ 2.19 V
(D) ○ - 2.19 V
(E) ○ 2.3 V

Question No.34 (Question Id - 22)
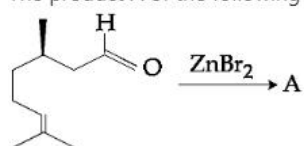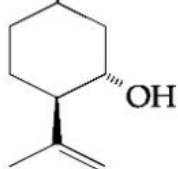
Identify the major products in this transformation :
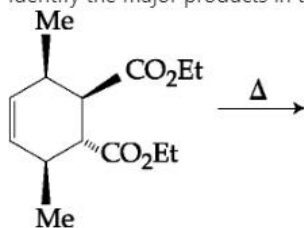
(A) ○

(B) ○

(C) ○

(D) ○

(E) ○

(Correct Answer)
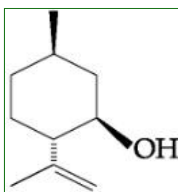
Question No.35 (Question Id - 28)

The product A of the following reaction is :
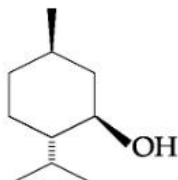

(A) ○

(D) ○

(Correct Answer)

(E) ○

Question No.36 (Question Id - 14)

The observed fluorescence lifetime of a certain fluorophore is 25.0×10^{-9} s and its fluorescence quantum yield is 0.50. The rate constant for fluorescence K_F is :

(A) ○ $12.5 \times 10^7 \ s^{-1}$

(B) ○ $0.5 \times 10^7 \ s^{-1}$

(C) ○ **$2.0 \times 10^7 \ s^{-1}$ (Correct Answer)**

(D) ○ $4.0 \times 10^7 \ s^{-1}$

(E) ○ $5.0 \times 10^8 \ s^{-1}$

Question No.37 (Question Id - 13)

Given that for a certain reaction, K_{eq} at 300 K is 20.0 and $\Delta H° = 100 \ kJmol^{-1}$, the value of K_{eq} for the same reaction at 400 K, assuming $\Delta H°$ to be independent of temperature, is closest to :
[$R = 8.3 \ JK^{-1}mol^{-1}$]

(A) ○ **$20e^{10}$ (Correct Answer)**

(B) ○ $20e^{83}$

(C) ○ $\dfrac{e^{20}}{10}$

(D) ○ $40e$

(E) ○ $20e$
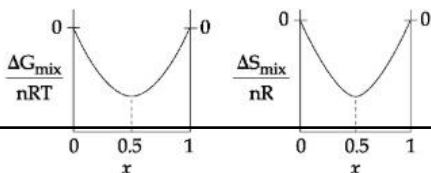

Question No.38 (Question Id - 48)

Consider a metal complex where the metal ion is present in a trigonalbipyramidal geometry. In your opinion, which of the following order according to the energy of d-orbitals is correct ?

(A) ○ $d_{x^2-y^2} > d_{z^2} > d_{xy} > d_{xz} = d_{yz}$

(B) ○ **$d_{z^2} > d_{xy} = d_{x^2-y^2} > d_{xz} = d_{yz}$ (Correct Answer)**

(C) ○ $d_{z^2} > d_{xz} = d_{yz} > d_{xy} > d_{x^2-y^2}$

(D) ○ $d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{xz} = d_{yz}$

(E) ○ $d_{z^2} = d_{x^2-y^2} > d_{xy} = d_{yz} = d_{zx}$
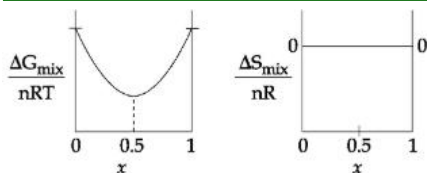

Question No.39 (Question Id - 11)

For an ideal mixture composed of two components, which of the following is correct ? [x is the mole fraction of one of the components in the mixture]

(A) ○

(E) ○

Question No.40 (Question Id - 36)
Choose the **correct** set of answers among the following sets :

A. Lowest angle XPX (X = F, Cl or Br) among :
     (a) F_3PO, (b) Cl_3PO, (c) Br_3PO

B. Lowest angle XCX (X = F, Cl or CH_3) among :
     (a) $F_2C = O$, (b) $Cl_2C = O$, (c) $Me_2C = O$

C. Lowest energy of inversion among :
     (a) $N(CH_3)_3$, (b) $P(CH_3)_3$, (c) $As(CH_3)_3$

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

(A) ○ A(a), B(b), C(c)
(B) ○ A(c), B(a), C(b)
(C) ○ A(a), B(b), C(a)
(D) ○ **A(a), B(a), C(a) (Correct Answer)**
(E) ○ A(b), B(b), C(b)

Question No.41 (Question Id - 3)
Assume an experimental measurement can predict the position of an electron with an accuracy of $\pm 1 \times 10^{-11}$ m at time t. The uncertainty in the electron's position after (t + 10) s would be :

(A) ○ 2.9×10^{11} m
(B) ○ **5.8×10^4 km (Correct Answer)**
(C) ○ 6.2×10^7 km
(D) ○ 5.0×10^5 m
(E) ○ 11.6×10^3 m

Question No.42 (Question Id - 46)
Consider you have five complex solution in water, where the concentration of each solution are 0.5 mM.

A. $[CoCl_4]^{2-}$

B. $[Co(H_2O)_6]^{2+}$

C. $[Cr(H_2O)_6]^{3+}$

D. $[Mn(H_2O)_6]^{2+}$

E. $[Fe(CN)_6]^{2+}$

In your opinion, which of the above complex will have highest molar extinction coefficient value for d - d transition ?

(A) ○ **A (Correct Answer)**
(B) ○ B
(C) ○ C
(D) ○ D
(E) ○ E

Question No.43 (Question Id - 35)
Choose the **correct** set of answers among following :

A. Highest solubility in water between the following compounds :
     (a) CsF, (b) NaF

---

estion No.44 (Question Id - 15)

Following molecules show intense $\pi \rightarrow \pi^*$ electronic transitions in UV-region. Which order of the transition wavelengths is correct for the molecules ?

A. $>C=N\diagdown$

B. $-C\equiv C-$

C. $O=$⬡$=O$
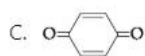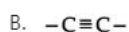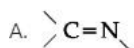
(A) ○ A = B > C
(B) ○ **B < A < C (Correct Answer)**
(C) ○ B > C > A
(D) ○ A > B = C
(E) ○ C < B < A

Question No.45 (Question Id - 43)

Alkene hydrogenation reactions of the following substrates were studied in the presence of Wilkinson's catalyst. Different rate constants were observed for the different substrates. In your opinion, which of the following order of rate constants are correct for the mentioned reaction ?
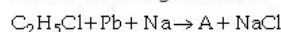
A.

B.

C.

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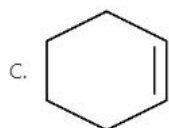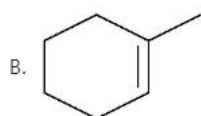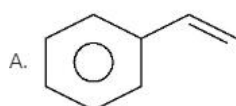
Choose the **correct** answer from the options given below :

(A) ○ **A > D > C > B (Correct Answer)**
(B) ○ D > B > C > A
(C) ○ B > C > D > A
(D) ○ A > C > D > B
(E) ○ D > A > C > B

Question No.46 (Question Id - 42)

For the following reaction :
$$C_2H_5Cl + Pb + Na \rightarrow A + NaCl$$
The structure of A is :
(A) ○ **$(C_2H_5)_4Pb$ (Correct Answer)**
(B) ○ $(C_2H_5)_2Pb$
(C) ○ $Pb_2(C_2H_5)_2$
(D) ○ $(C_2H_5)_6Pb$
(E) ○ $(C_2H_5)_3PbCl$

Question No.47 (Question Id - 9)
The below question has been dropped and full marks are awarded.

A container containing 1.0 mole of an ideal monoatomic gas at 127°C is expanded reversibly and isothermally from an initial pressure of 3.0 atm to a final pressure of 1.0 atm. The values of ω, ΔH and ΔS_{sys} for this process are :
[R = 8.3 Jmol^{-1}K^{-1}]

(A) ○ $\omega = - 9.96$ kJ ; $\Delta H = 0$; $\Delta S_{sys} = 24.9$ JK^{-1}

C. H_2N—CH_2—$C(=O)$—OH

D. (indole-CH2-CH(NH2)-COOH structure)
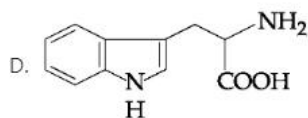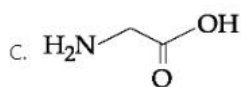
Which of the following statement will be the **correct** one ?

(A) ◯ A = Proline, B = Alanine, C = Glycine, D = Tryptophan
(B) ◯ A = Proline, B = Alanine, C = Tryptophan, D = Glycine
(C) ◯ A = Glycine, B = Proline, C = Alanine, D = Tryptophan
(D) ◯ A = Alanine, B = Proline, C = Tryptophan, D = Glycine
(E) ◯ **A = Alanine, B = Proline, C = Glycine, D = Tryptophan (Correct Answer)**

Question No.49 (Question Id - 17)

(molecule structure with labels Me, O, 5, 4, 6, 3, O, 2, 1, OH, (A))
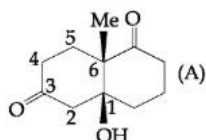
Predict the (R), (S) nomenclature in the given molecule (A) :

(A) ◯ **1S, 6S (Correct Answer)**
(B) ◯ 1R, 6R
(C) ◯ 1R, 6S
(D) ◯ 1S, 6R
(E) ◯ 1R, 5S

Question No.50 (Question Id - 34)
Choose the correct set of answers among following :

A. Lowest melting point among following compounds :
   (a) Si, (b) Ge, (c) Sn

B. A tetrahalide that 'does not' exist
   (a) SnI_4, (b) GeI_4, (c) PbI_4

C. Which of the following MH_4 will react with 0.5 N NaOH ?
   (a) CH_4, (b) SiH_4, (c) GeH_4

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

(A) ◯ A(a), B(a), C(c)
(B) ◯ A(c), B(b), C(c)
(C) ◯ **A(c), B(c), C(b) (Correct Answer)**
(D) ◯ A(b), B(c), C(b)
(E) ◯ A(c), B(b), C(b)

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