Graduate Aptitude Test in Engineering

Notations :

1.Options shown in green color and with ✔ icon are correct.

2.Options shown in red color and with ✖ icon are incorrect.

Question Paper Name: CY: CHEMISTRY 31st Jan Shift1
Number of Questions: 65
Total Marks: 100.0

Wrong answer for MCQ will result in negative marks, (-1/3) for 1 mark Questions and (-2/3) for 2 marks Questions.

General Aptitude

Number of Questions: 10
Section Marks: 15.0

Q.1 to Q.5 carry 1 mark each & Q.6 to Q.10 carry 2 marks each.

Question Number : 1 Question Type : MCQ

Choose the most appropriate word from the options given below to complete the following sentence.

The principal presented the chief guest with a _____, as token of appreciation.

(A) momento (B) memento (C) momentum (D) moment

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 2 Question Type : MCQ

Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Frogs _____.

(A) croak (B) roar (C) hiss (D) patter

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 3 Question Type : MCQ

Choose the word most similar in meaning to the given word:

Educe

(A) Exert (B) Educate (C) Extract (D) Extend

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 4 Question Type : MCQ

Operators □, ◊ and → are defined by: $a \square b = \frac{a-b}{a+b}$; $a \lozenge b = \frac{a+b}{a-b}$; $a \rightarrow b = ab$.

Find the value of $(66 \square 6) \rightarrow (66 \lozenge 6)$.

(A) −2 (B) −1 (C) 1 (D) 2

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 5 Question Type : MCQ

If $\log_x (5/7) = -1/3$, then the value of x is

(A) 343/125
(B) 125/343
(C) −25/49
(D) −49/25

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 6 Question Type : MCQ

The following question presents a sentence, part of which is underlined. Beneath the sentence you find four ways of phrasing the underlined part. Following the requirements of the standard written English, select the answer that produces the most effective sentence.

Tuberculosis, together with its effects, ranks one of the leading causes of death in India.

(A) ranks as one of the leading causes of death
(B) rank as one of the leading causes of death
(C) has the rank of one of the leading causes of death
(D) are one of the leading causes of death

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 7 Question Type : MCQ

Read the following paragraph and choose the correct statement.

Climate change has reduced human security and threatened human well being. An ignored reality of human progress is that human security largely depends upon environmental security. But on the contrary, human progress seems contradictory to environmental security. To keep up both at the required level is a challenge to be addressed by one and all. One of the ways to curb the climate change may be suitable scientific innovations, while the other may be the Gandhian perspective on small scale progress with focus on sustainability.

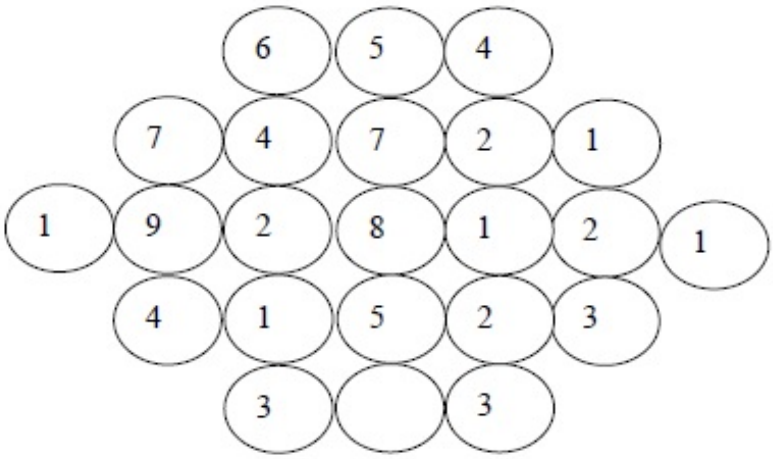
(A) Human progress and security are positively associated with environmental security.
(B) Human progress is contradictory to environmental security.
(C) Human security is contradictory to environmental security.
(D) Human progress depends upon environmental security.

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 8 Question Type : NAT

Fill in the missing value



Correct Answer :

3

Question Number : 9 Question Type : MCQ

A cube of side 3 units is formed using a set of smaller cubes of side 1 unit. Find the proportion of the number of faces of the smaller cubes visible to those which are NOT visible.

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

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 10 Question Type : MCQ

Humpty Dumpty sits on a wall every day while having lunch. The wall sometimes breaks. A person sitting on the wall falls if the wall breaks.

Which one of the statements below is logically valid and can be inferred from the above sentences?

(A) Humpty Dumpty always falls while having lunch
(B) Humpty Dumpty does not fall sometimes while having lunch
(C) Humpty Dumpty never falls during dinner
(D) When Humpty Dumpty does not sit on the wall, the wall does not break

Options :

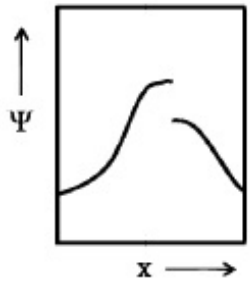
1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

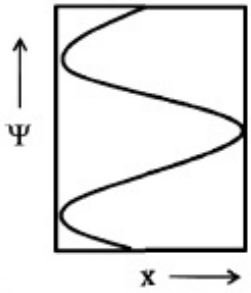
	Chemistry
Number of Questions:	55
Section Marks:	85.0

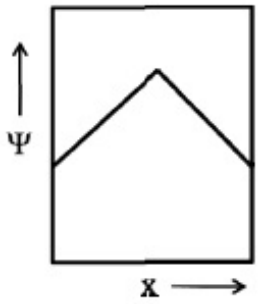
Q.11 to Q.35 carry 1 mark each & Q.36 to Q.65 carry 2 marks each.

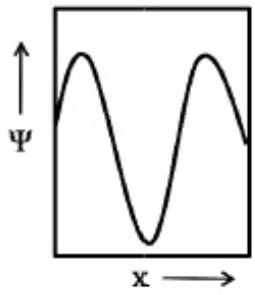
Question Number : 11 Question Type : MCQ

Which one of the following plots represents an acceptable wavefunction?

(A) 

(B) 

(C) 

(D) 

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 12 Question Type : MCQ

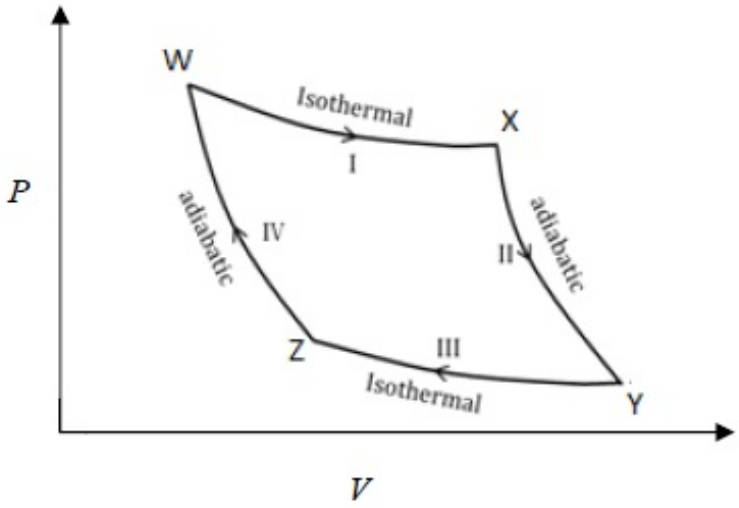
When the operator, $-\hbar^2 d^2/dx^2$, operates on the function e^{-ikx}, the result is

(A) $k^2\hbar^2 e^{-ikx}$ (B) $ik^2\hbar^2 e^{-ikx}$ (C) $i\hbar^2 e^{-ikx}$ (D) $\hbar^2 e^{-ikx}$

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 13 Question Type : MCQ



From the above Carnot cycle undergone by an ideal gas, identify the processes in which the change in internal energy is **NON-ZERO**.

(A) I and II (B) II and IV (C) II and III (D) I and IV

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 14 Question Type : MCQ

For an ideal gas with molar mass M, the molar translational entropy at a given temperature is proportional to

(A) $M^{3/2}$ (B) $M^{1/2}$ (C) e^{M} (D) $\ln(M)$

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 15 Question Type : MCQ

Which one of the following defines the absolute temperature of a system?

(A) $\left(\frac{\partial U}{\partial S}\right)_V$ (B) $\left(\frac{\partial A}{\partial S}\right)_V$ (C) $\left(\frac{\partial H}{\partial S}\right)_V$ (D) $\left(\frac{\partial G}{\partial S}\right)_V$

Options :

1. ✔ A
2. ✖ B

3. ✖ C
4. ✖ D

Question Number : 16 Question Type : MCQ

Which of the following properties are characteristic of an ideal solution?

(i) $(\Delta_{mix}G)_{T,P}$ is negative

(ii) $(\Delta_{mix}S)_{T,P}$ is positive

(iii) $(\Delta_{mix}V)_{T,P}$ is positive

(iv) $(\Delta_{mix}H)_{T,P}$ is negative

(A) (i) and (iv) (B) (i) and (ii) (C) (i) and (iii) (D) (iii) and (iv)

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 17 Question Type : MCQ

The expression for the equilibrium constant (K_{eq}) for the enzyme catalyzed reaction given below, is

$$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \underset{k_4}{\overset{k_3}{\rightleftharpoons}} P + E$$

(A) $\frac{k_1k_3}{k_2k_4}$ (B) $\frac{k_1k_2}{k_3k_4}$ (C) $\frac{k_2k_3}{k_1k_4}$ (D) $\frac{k_1k_4}{k_2k_3}$

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 18 Question Type : NAT

Given the E^0 values for the following reaction sequence,

$$Mn^{6+} \xrightarrow{1.28\ V} Mn^{5+} \xrightarrow{2.9\ V} Mn^{4+} \xrightarrow{0.96\ V} Mn^{3+} \xrightarrow{1.5\ V} Mn^{2+}$$

the computed value of E^0 for $Mn^{6+} \rightarrow Mn^{2+}$ (in volts) is _____

Correct Answer :
1.6 to 1.7

Question Number : 19 Question Type : MCQ

The absorption spectrum of $[Ti(H_2O)_6]^{3+}$ in solution comprises of a maximum with a shoulder. The reason for the shoulder is

(A) ligand-to-metal charge transfer (LMCT)
(B) metal-to-ligand charge transfer (MLCT)
(C) Jahn-Teller distortion
(D) nephelauxetic effect

Options :
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 20 Question Type : MCQ

The ease of formation of the adduct, $NH_3 \cdot BX_3$ (where, X = F, Cl, Br) follows the order

(A) $BBr_3 < BCl_3 < BF_3$
(B) $BCl_3 < BF_3 < BBr_3$
(C) $BF_3 < BCl_3 < BBr_3$
(D) $BBr_3 < BF_3 < BCl_3$

Options :
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 21 Question Type : MCQ

An efficient catalyst for hydrogenation of alkenes is $[Rh(PPh_3)_3Cl]$. However, $[Ir(PPh_3)_3Cl]$ does not catalyze this reaction, because

(A) PPh_3 binds stronger to Ir than to Rh
(B) Cl binds stronger to Ir than to Rh
(C) PPh_3 binds stronger to Rh than to Ir
(D) Cl binds stronger to Rh than to Ir

Options :
1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 22 Question Type : MCQ

Among the given pH values, the O_2 binding efficiency of hemoglobin is maximum at

(A) 6.8 (B) 7.0 (C) 7.2 (D) 7.4

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 23 Question Type : MCQ

The intense red color of $[Fe(bpy)_3]^{2+}$ (bpy = 2,2′-bipyridine) is due to

(A) metal-to-ligand charge transfer (MLCT)
(B) ligand-to-metal charge transfer (LMCT)
(C) *d-d* transition
(D) inter-valence charge transfer (IVCT)

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 24 Question Type : MCQ

The compound with planar geometry is

(A) $N(t\text{-}Bu)_3$ (B) NPh_3 (C) NF_3 (D) $N(SiH_3)_3$

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 25 Question Type : MCQ

The electrical conductivity of a metal

(A) increases with increasing temperature
(B) decreases with increasing temperature
(C) is independent of temperature
(D) shows oscillatory behaviour with temperature

Options :

1. ✖ A
2. ✔ B

3. ✖ C
4. ✖ D

Question Number : 26 Question Type : MCQ

Which one of the following statements is **INCORRECT**?

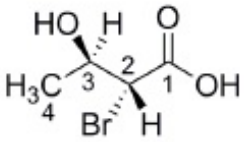
(A) Frenkel defect is a cation vacancy and a cation interstitial.
(B) Frenkel defect is an anion vacancy and a cation interstitial.
(C) Density of a solid remains unchanged in case of Frenkel defects.
(D) Density of a solid decreases in case of Schottky defects.

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 27 Question Type : MCQ

The absolute configuration of *C*2 and *C*3 in the following compound is



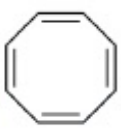
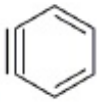
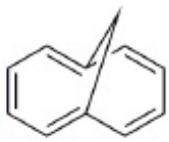
(A) 2*R*, 3*S* (B) 2*S*, 3*R* (C) 2*S*, 3*S* (D) 2*R*, 3*R*

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 28 Question Type : MCQ

Among the following compounds, the one that is non-aromatic, is

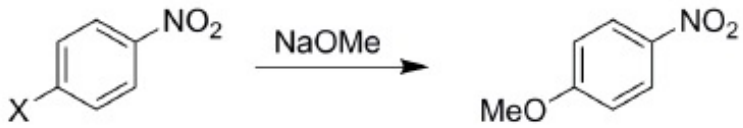
(A) 
(B) 
(C) 
(D) 

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 29 Question Type : MCQ

The correct order of reactivity of *p*-halonitrobenzenes in the following reaction is



(X = F, Cl, Br, I)

(A) *p*-chloronitrobenzene > *p*-iodonitrobenzene > *p*-fluoronitrobenzene > *p*-bromonitrobenzene
(B) *p*-fluoronitrobenzene > *p*-chloronitrobenzene > *p*-bromonitrobenzene > *p*-iodonitrobenzene
(C) *p*-iodonitrobenzene > *p*-bromonitrobenzene > *p*-chloronitrobenzene > *p*-fluoronitrobenzene
(D) *p*-bromonitrobenzene > *p*-fluoronitrobenzene > *p*-iodonitrobenzene > *p*-chloronitrobenzene

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 30 Question Type : MCQ

Tollen's test is **NEGATIVE** for

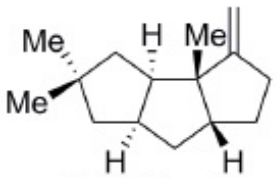
(A) mannose (B) maltose (C) glucose (D) sucrose

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 31 Question Type : MCQ

The compound given below is a



(Hirsutene)

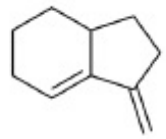
(A) sesterterpene (B) monoterpene (C) sesquiterpene (D) triterpene

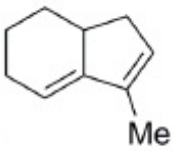
Options :

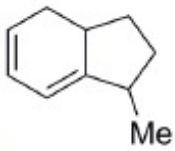
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

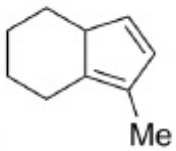
Question Number : 32 Question Type : MCQ

Amongst the following, the compound that **DOES NOT** act as a diene in Diels-Alder reaction is

(A) 

(B) 

(C) 

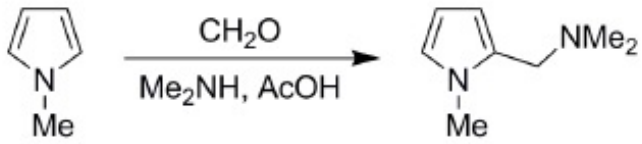
(D) 

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 33 Question Type : MCQ

The following conversion is an example of



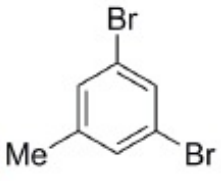
(A) Arndt-Eistert homologation
(B) Mannich reaction
(C) Michael addition
(D) Chichibabin amination reaction

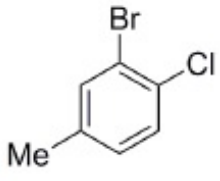
Options :

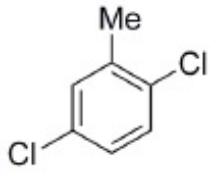
1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

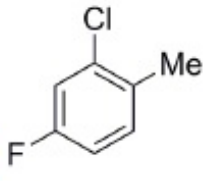
Question Number : 34 Question Type : MCQ

The mass spectrum of a dihalo compound shows peaks with relative intensities of 1:2:1 corresponding to M, M+2 and M+4 (M is the mass of the molecular ion), respectively. The compound is

(A) 

(B) 

(C) 

(D) 

Options :

1. ✔ A
2. ✖ B
3. ✖ C

4. ✖ D

Question Number : 35 Question Type : NAT

Reaction of benzaldehyde and *p*-methylbenzaldehyde under McMurry coupling conditions ($TiCl_3$ and $LiAlH_4$) gives a mixture of alkenes. The number of alkenes formed is _____

Correct Answer :
6

Question Number : 36 Question Type : NAT

The difference in the ground state energies (kJ/mol) of an electron in one-dimensional boxes of lengths 0.2 nm and 2 nm is _____

Correct Answer:
896 to 900

Question Number : 37 Question Type : NAT

The mean ionic activity coefficient of 0.001 molal $ZnSO_4$ (aq) at 298 K according to the Debye-Hückel limiting law is (Debye-Hückel constant is 0.509 $molal^{-1/2}$) _____

Correct Answer :
0.73 to 0.75

Question Number : 38 Question Type : MCQ

The process given below follows the Langmuir adsorption isotherm.

$$A_2\,(g) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2\,A_{ads}$$

If θ denotes the surface coverage and P denotes the pressure, the slope of the plot of $1/\theta$ versus $1/\sqrt{P}$ is

(A) $1/(K_{eq})^2$ (B) $1/K_{eq}$ (C) $-1/K_{eq}$ (D) $1/(K_{eq})^{1/2}$

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 39 Question Type : NAT

For a gas phase unimolecular reaction at temperature 298 K, with a pre-exponential factor of $2.17 \times 10^{13}\ s^{-1}$, the entropy of activation ($J\ K^{-1}\ mol^{-1}$) is _____

Correct Answer :
10.2 to 10.6

Question Number : 40 Question Type : NAT

A liquid has vapor pressure of $2.02 \times 10^{3}\ N\ m^{-2}$ at 293 K and heat of vaporization of 41 kJ mol^{-1}. The boiling point of the liquid (in Kelvin) is _____

Correct Answer :
380 to 385

Question Number : 41 Question Type : MCQ

The rotational partition function of a diatomic molecule with energy levels corresponding to $J = 0$ and 1, is (where, ε is a constant)

(A) $1+e^{-2\varepsilon}$ (B) $1+3e^{-2\varepsilon}$ (C) $1+ e^{-3\varepsilon}$ (D) $1+3e^{-3\varepsilon}$

Options :
1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 42 Question Type : NAT

The internal energy of an ideal gas follows the equation $U = 3.5\ PV + k$, where k is a constant. The gas expands from an initial volume of 0.25 m^3 to a final volume of 0.86 m^3. If the initial pressure is 5 $N\ m^{-2}$, the change in internal energy (in Joules) is (given $PV^{1.3}$ = constant) _____

Correct Answer:
-1.38 to -1.33

Question Number : 43 Question Type : NAT

The solubility product of AgBr(s) is 5×10^{-13} at 298 K. If the standard reduction potential of the half-cell, $E^0_{Ag|AgBr(s)|Br^-}$ is 0.07 V, the standard reduction potential, $E^0_{Ag^+|Ag}$ (in volts) is _____.

Correct Answer:
0.79 to 0.82

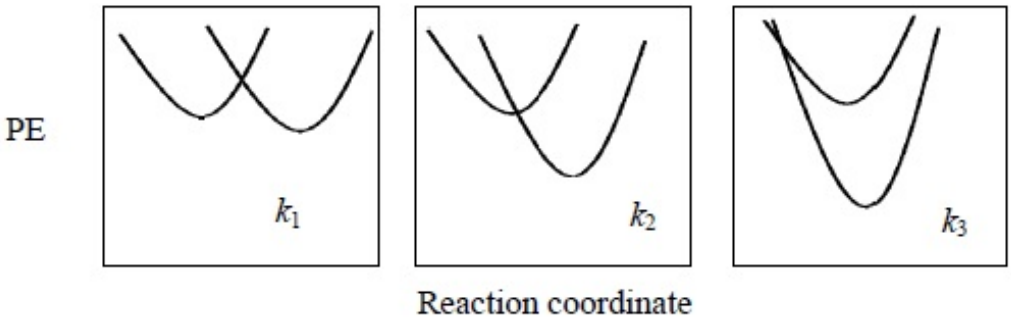
Question Number : 44 Question Type : NAT

One mole of a substance is heated from 300 K to 400 K at constant pressure. The C_P of the substance is given by, C_P (J $K^{-1}mol^{-1}$) $= 5 + 0.1\,T$. The change in entropy, in J $K^{-1}mol^{-1}$, of the substance is _____

Correct Answer :
11.3 to 11.5

Question Number : 45 Question Type : MCQ

The potential energy (PE) versus reaction coordinate diagrams for electron transfer reactions with rate constants k_1, k_2 and k_3, are given below. The increasing order of the rate constants is



(A) $k_2 < k_3 < k_1$ (B) $k_2 < k_1 < k_3$ (C) $k_3 < k_2 < k_1$ (D) $k_3 < k_1 < k_2$

Options :
1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 46 Question Type : MCQ

The distance between two successive (110) planes in a simple cubic lattice with lattice parameter 'a' is

(A) $\sqrt{2}\,a$ (B) $\sqrt{3}\,a$ (C) $2\sqrt{2}\,a$ (D) $\frac{a}{\sqrt{2}}$

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 47 Question Type : MCQ

The percent transmittance of 8×10^{-5} M solution of $KMnO_4$ is 39.8 when measured at 510 nm in a cell of path length of 1 cm. The absorbance and the molar extinction coefficient (in $M^{-1}\,cm^{-1}$) of this solution are, respectively,

(A) 0.30 and 4500 (B) 0.35 and 4800 (C) 0.4 and 5000 (D) 0.48 and 5200

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 48 Question Type : MCQ

The value of 'g' and the number of signals observed for the reference standard, diphenylpicrylhydrazyl (DPPH), in the solid state ESR spectrum are, respectively,

(A) 2.0036 and 1 (B) 2.0036 and 3 (C) 2.2416 and 1 (D) 2.2416 and 3

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 49 Question Type : MCQ

Ammonolysis of S_2Cl_2 in an inert solvent gives

(A) S_2N_2 (B) $S_2N_2Cl_2$ (C) $S_2N_2H_4$ (D) S_4N_4

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 50 Question Type : MCQ

The complexes $K_2[NiF_6]$ and $K_3[CoF_6]$ are

(A) both paramagnetic
(B) both diamagnetic
(C) paramagnetic and diamagnetic, respectively
(D) diamagnetic and paramagnetic, respectively

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 51 Question Type : MCQ

The point group of IF_7 is

(A) D_{6h} (B) D_{5h} (C) C_{6v} (D) C_{5v}

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 52 Question Type : MCQ

When one CO group is replaced by PPh_3 in $[Cr(CO)_6]$, which one of the following statements is **TRUE**?

(A) The Cr-C bond length increases and CO bond length decreases
(B) The Cr-C bond length decreases and CO bond length decreases
(C) The Cr-C bond length decreases and CO bond length increases
(D) The Cr-C bond length increases and CO bond length increases

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 53 Question Type : MCQ

Identify X in the reaction, $[Pt(NH_3)_4]^{2+} + 2\ HCl \rightarrow X$

(A) *cis*-$[PtCl_2(NH_3)_2]$

(B) *trans*-$[PtCl_2(NH_3)_2]$

(C) $[PtCl(NH_3)_3]^+$

(D) $[PtCl_3(NH_3)]^-$

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 54 Question Type : MCQ

Identify the function of hemocyanin and the metal responsible for it.

(A) O_2 transport and Fe

(B) O_2 transport and Cu

(C) electron transport and Fe

(D) electron transport and Cu

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 55 Question Type : NAT

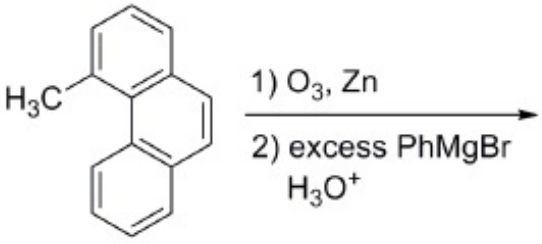
The limiting current (in μA) from the reduction of 3×10^{-4} M Pb^{2+}, using a dropping mercury electrode (DME) with characteristics, $m = 3.0$ mg s^{-1} and $t = 3$s, is
(diffusion coefficient of $Pb^{2+} = 1.2 \times 10^{-5}$ $cm^2\ s^{-1}$) _____

Correct Answer :

3.5 to 3.8

Question Number : 56 Question Type : NAT

The number of possible stereoisomers obtained in the following reaction is _____

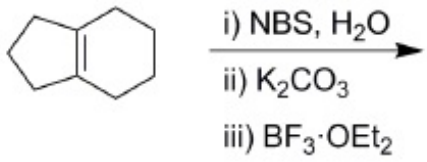


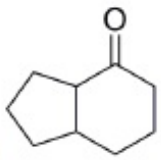
Correct Answer :

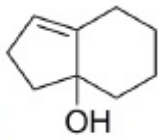
8

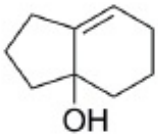
Question Number : 57 Question Type : MCQ

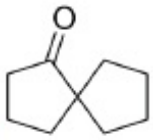
The major product formed in the following reaction is



(A) 

(B) 

(C) 

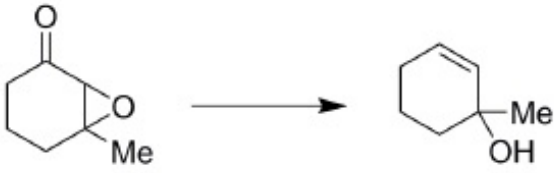
(D) 

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 58 Question Type : MCQ

The most suitable reagent(s) to effect the following transformation is



(A) N_2H_4, KOH, heat

(B) $TsNHNH_2$, CF_3COOH

(C) $LiAlH_4$

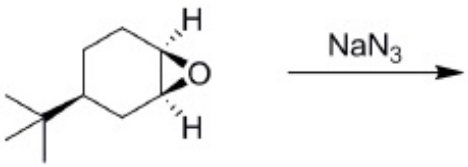
(D) Na, liq. NH_3

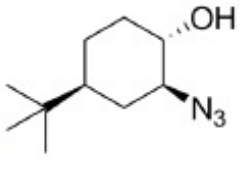
Options :

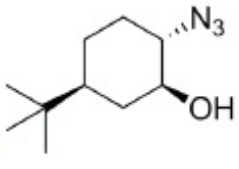
1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

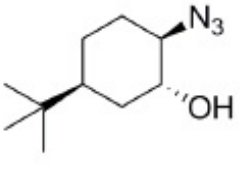
Question Number : 59 Question Type : MCQ

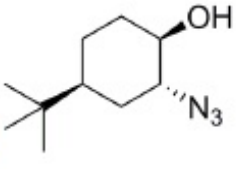
The major product formed in the following reaction is



(A)


(B)


(C)


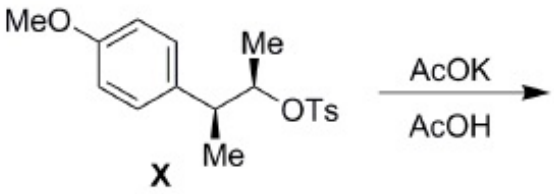
(D)


Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

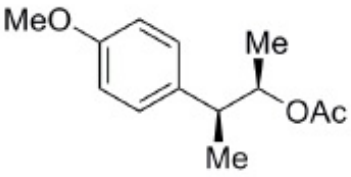
Question Number : 60 Question Type : MCQ

Solvolysis of the optically active compound **X** gives, mainly



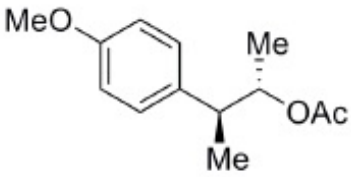
X

(A)



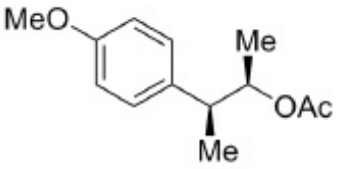
(optically active)

(B)



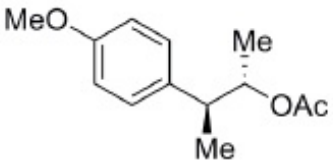
(optically active)

(C)



racemic
(optically inactive)

(D)



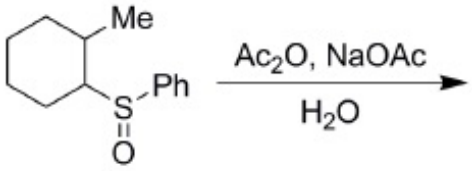
racemic
(optically inactive)

Options :

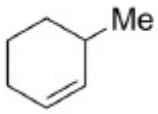
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 61 Question Type : MCQ

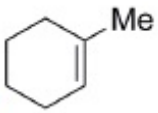
The major product formed in the following reaction is



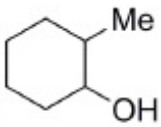
(A)



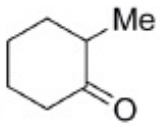
(B)



(C)



(D)

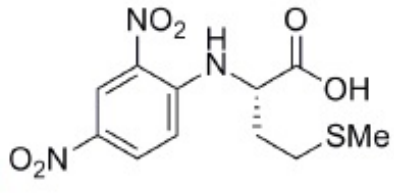


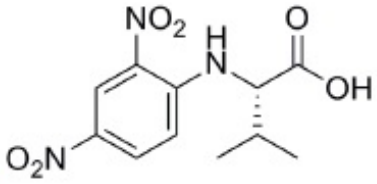
Options :

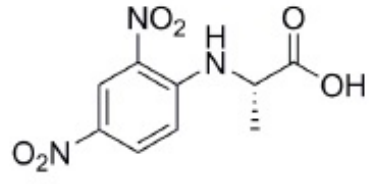
1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

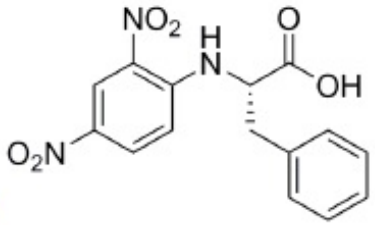
Question Number : 62 Question Type : MCQ

The tetrapeptide, Ala-Val-Phe-Met, on reaction with Sanger's reagent, followed by hydrolysis gives

(A) 

(B) 

(C) 

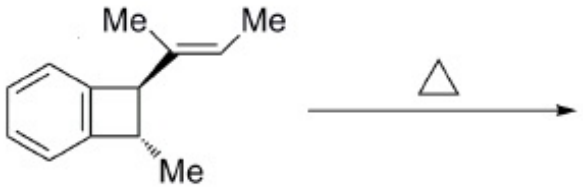
(D) 

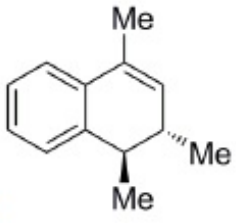
Options :

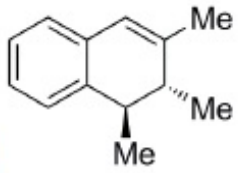
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

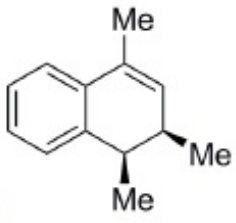
Question Number : 63 Question Type : MCQ

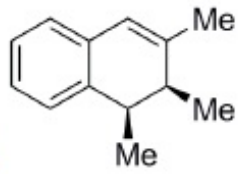
The major product formed in the following reaction is



(A) 

(B) 

(C) 

(D) 

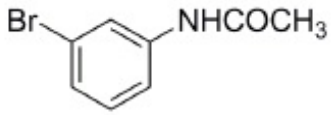
Options :

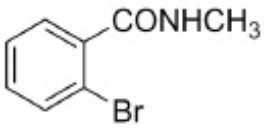
1. ✖ A
2. ✔ B
3. ✖ C

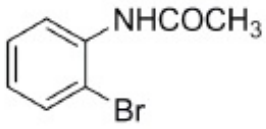
4. ✖ D

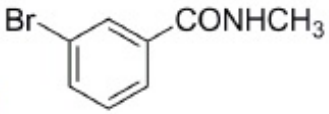
Question Number : 64 Question Type : MCQ

The Beckmann rearrangement of a bromoacetophenone oxime (C_8H_8BrNO) gives a major product having the following ^1H NMR (δ, ppm): 9.89 (s, 1H), 7.88 (s, 1H), 7.45 (d, 1H, J = 7.2 Hz), 7.17 (m, 1H), 7.12 (d, 1H, J = 7.0 Hz), 2.06 (s, 3H). The structure of the product is

(A) 

(B) 

(C) 

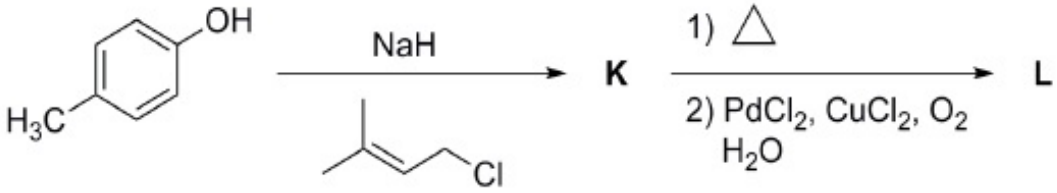
(D) 

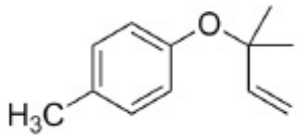
Options :

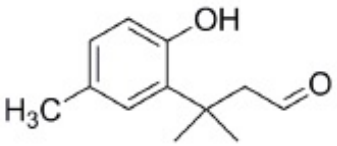
1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

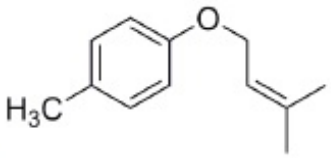
Question Number : 65 Question Type : MCQ

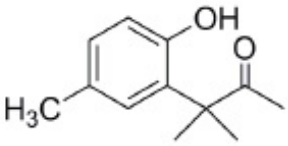
The major products, **K** and **L** formed in the following reactions are

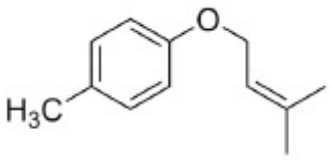


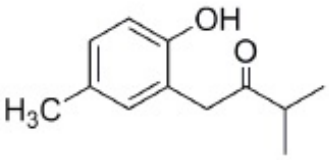
(A) **K** = 

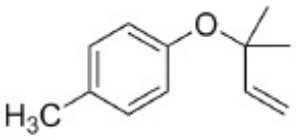
L = 

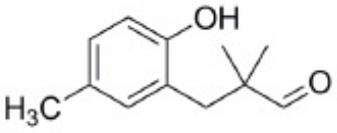
(B) **K** = 

L = 

(C) **K** = 

L = 

(D) **K** = 

L = 

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D