PROVISIONAL ANSWER KEY

Question Paper Code:	110/2025/OL
Category Code:	325/2024
Exam:	Chemist/Conservation Officer
Date of Test	08-10-2025
Department	COIRFED, STATE ARCHIVES

Question1:-The reaction of ClF_3 and SbF_5 results in the formation

A:-$\left[ClF_2^+\right]\left[SbF_6^-\right]$

B:-$\left[ClF^{2+}\right]\left[SbF_7^{2-}\right]$

C:-$\left[SbF_4^+\right]\left[ClF_4^-\right]$

D:-$\left[SbF_3^{2+}\right]\left[ClF_5^{2-}\right]$

Correct Answer:- Option-A

Question2:-The CH_2 species is isolobal with :

A:-$(CO)_4Co^-$

B:-$(CO)_5Mn$

C:-$(CO)_5Fe$

D:-$(CO)_3Co$

Correct Answer:- Option-C

Question3:-Which lanthanide ion forms a coloured aqua complex?

A:-Gd^{3+}

B:-Nd^{3+}

C:-Yb^{3+}

D:-Lu^{3+}

Correct Answer:- Option-B

Question4:-According to Wade's rules:

A:-$Rh_4(CO)_{12}$ is a *nido*-cluster, while $Ir_4(CO)_{12}$is an *arachno*-cluster

B:-$Rh_4(CO)_{12}$ is an arachno-cluster, while $Ir_4(CO)_{12}$is an *nido*-cluster

C:-Both a *nido*-clusters

D:-Both are arachno-clusters

Correct Answer:- Option-C

Question5:-The correct order of ionic radius is :

A:-$Sr^{2+}>Zn^{2+}>Rb^+>S^{2-}$

B:-$S^{2-}>Rb^+>Sr^{2+}>Zn^{2+}$

C:-$Rb^+>Sr^{2+}>S^{2-}>Zn^{2+}$

D:-$Zn^{2+}>Rb^{+}>S^{2-}\rightarrow Sr^{2+}$

Correct Answer:- Option-B

Question6:-The *styx* number of $B_4H_{10}$is

A:-4004

B:-4012

C:-4121

D:-4114

Correct Answer:- Option-B

Question7:-Which of the following is not an isoelectronic pair?

A:-$CO_3^{2-}$and $NSCl_2^-$

B:-NO_3^- and SO_3

C:-$NSCl_2^-$ and $OSCl_2$

D:-N_5^+ and $OCNCO^+$

Correct Answer:- Option-A

Question8:-Which is not true for zeolites?

A:-They are crystalline microporous aluminosilicates

B:-Catalytic activity can be tuned via bronsted acidity of their cavities

C:-Aluminium-rich systems are hydrophobic

D:-ZSM-5 is used to synthesize *o*-xylene

Correct Answer:- Option-C

Question9:-The extent of ionization of the three hydrogen halides in acetic acid varies as :

A:-HI>HBr>HCl

B:-HCl>HBr>HI

C:-HI=HBr>HCl

D:-HCl=HBr>HI

Correct Answer:- Option-A

Question10:-Which statements accurately describe the associative substitution reactions of octahedral complexes?

i. A large positive value of $\Delta V^{\neq}$

ii. A large negative value of $\Delta V^{\neq}$

iii. A large negative value of $\Delta S^{\neq}$

iv A large positive value of $\Delta S^{\neq}$

A:-both i and iii

B:-both i and iv

C:-both ii and iii

D:-both ii and iv

Correct Answer:- Option-C

Question11:-The possible number of microstates corresponding to an electronic configuration having the ground state term ^5D is

A:-45

B:-210

C:-10

D:-252

Correct Answer:- Option-B

Question12:-The metal present in Chlorophyll is

A:-Zn

B:-Fe

C:-Mg

D:-None of the above

Correct Answer:- Option-C

Question13:-Which of the following compounds is an example of an organometallic compound?

A:-Sodium cyanide (NaCN)

B:-Calcium carbide (CaC_2)

C:-Ferrocene $\left(Fe(C_5H_5)_2\right)$

D:-Potassium cyanide (KCN)

Correct Answer:- Option-C

Question14:-The ^{19}F NMR spectra of PCl_2F_3 in isopentane, the resonances of fluorine at temperatures ≥ -22 °C are appeared as

A:-Triplet

B:-Singlet

C:-Single doublet

D:-Doublet of triplets

Correct Answer:- Option-C

Question15:-The electrogenic activity of Na^+/K^+ pump is due to

A:-The development of positive potential inside the cell

B:-The continuous reduction of negative charge inside the cell

C:-The passive transport

D:-The development of negative potential inside the cell

Correct Answer:- Option-D

Question16:-What is the typical core structure of a cubane cluster?

A:-Tetrahedral

B:-Octahedral

C:-Cuboidal

D:-None of the above

Correct Answer:- Option-A

Question17:-Which of the following complex in which a σ- donar ligand is present with?

A:-$W(CH_3)_6$

B:-$K\left[PtCl_3(C_2H_4)\right]$

C:-$(\eta^5-C_5H_5)_2Fe$

D:-$(\eta^5-C_6H_6)_2Ru$

Correct Answer:- Option-A

Question18:-What are oxidation states of metal ion in the following complexes?

I. $K_2[PdCl_4]$

II. $Pd(PPh_3)_4$

III. $Pd(OAc)_2$

IV. ArPdBr where Ar is aryl

A:-2, 4, 2, 2

B:-2, 0, 2, 1

C:-2, 0, 2, 2

D:-0, 0, 0, 2

Correct Answer:- Option-C

Question19:-Which of the following complexes is significantly showing Jahn-Teller distortion

A:-$\left[Cu(H_2O)_6\right]^{2+}$

B:-$\left[Mn(H_2O)_6\right]^{2+}$

C:-$\left[Fe(CN)_6\right]^{4-}$

D:-$\left[Co(NH_3)_6\right]^{3+}$

Correct Answer:- Option-A

Question20:-Which type of metal complexes will exhibit an ESR spectrum?

A:-Diamagnetic complexes

B:-Paramagnetic complexes

C:-Both diamagnetic and paramagnetic complexes

D:-Neither diamagnatic nor paramagnetic complexes

Correct Answer:- Option-B

Question21:-Which of the following statements are correct about radioactive equilibrium

i. The shorter is the half life period, the more easily the equilibrium state is attained

ii. At equilibrium all the radioactive elements disintegrate at the same rate

iii. Radioactive equilibrium is reversible
iv. Radio equilibrium is irreversible

A:-i, ii and iii

B:-i, ii and iv

C:-ii and iii

D:-i and iii

Correct Answer:- Option-B

Question22:-Which is the carrier ion in sodium β-alumina solid electrolyte?

A:-Na^{+}

B:-Al^{3+}

C:-Both$Na^{+}\text{ and }Al^{3+}$

D:-O^{2-}

Correct Answer:- Option-A

Question23:-Coordination number and void volume for the lattice type HCP are

A:-8 and 26%

B:-12 and 26%

C:-8 and 74%

D:-12 and 74%

Correct Answer:- Option-B

Question24:-Which of the following statements are correct about photovoltaic effect.
i. light energy is converted to electrical energy and vice-versa using a semiconductor
ii. p-n junction semiconductor is used
iii. Only n-type semiconductor is used
iv. Electrons will migrate towards n-type semiconductor

A:-i ii and iv

B:-i, iii and iv

C:-ii and iv

D:-iii and iv

Correct Answer:- Option-C

Question25:-Find out the consequence of the stoichiometric crystal defect known as Frenkel defect

A:-Increase in dielectric constant of the crystal

B:-Decrease in dielectric constant of the crystal

C:-No change in dielectric constant of the crystal

D:-Decrease in density of the crystal

Correct Answer:- Option-A

Question26:-Identify the mixed metal oxide with spinel structure

A:-$FeTiO_3$

B:-$NaNbO_3$

C:-$FeCr_2O_4$

D:-$KMnO_4$

Correct Answer:- Option-C

Question27:-Compound which is not a metal nitride

A:-Na_3N

B:-NaN_3

C:-Mg_3N_2

D:-AlN

Correct Answer:- Option-B

Question28:-Identify the element produced by the (α,p) nuclear reaction of $_9F^{19}$

A:-$_{11}Na^{23}$

B:-$_9F^{20}$

C:-$_{10}Ne^{22}$

D:-$_{11}Na^{22}$

Correct Answer:- Option-C

Question29:-$CuSO_4$ crystalizes in the triclinic crystal system and has

A:-one plane of symmetry and one axis of symmetry

B:-three planes of symmetry and three axes of symmetry

C:-three planes of symmetry and one axis of symmetry

D:-no plane of symmetry and no axis of symmetry

Correct Answer:- Option-D

Question30:-Select a condition for a crystal to be a piezoelectric material

A:-it must be a metallic crystal

B:-It must be possess a centre of symmetry

C:-It must lack of centre of symmetry

D:-It must be a cubic crystal system

Correct Answer:- Option-C

Question31:-Bicyclo [2.2.2] oct-2-ene is

A:- 

B:- 

C:- 

D:- 

Correct Answer:- Option-B

Question32:-Which of the following pair is diastereomers?

i.  and 

ii.  and 

iii. Maleic acid and fumaric acid

A:-only i and ii

B:-only ii and iii

C:-only i and iii

D:-all of the above i, ii and iii

Correct Answer:- Option-D

Question33:-Which of the following is aromatic

i.  ii. 

iii.  iv. 

A:-only ii and iv

B:-only i, ii and iii

C:-only iii and iv

D:-all of the above i, ii, iii and iv

Correct Answer:- Option-B

Question34:-Which of the following statement is/are correct about SN^1 and SN^2 mechanism?

i. low concentration of nucleophile favours SN^2 reaction and high concentration of nucleophile favours SN^1 reaction mechanism

ii. Strong nucleophile favours SN^2 reaction and weak nucleophile favours SN^1 reaction mechanism

iii. SN^1reaction is favoured by polar protic solvent, SN^2 reaction is favoured by polar aprotic solvent

A:-only ii and iii

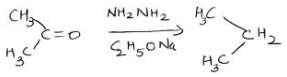
B:-only i and ii

C:-only i and iii

D:-all of the above statement i, ii and iii

Correct Answer:- Option-A

Question35:-The reaction

 is an example of

A:-Knoevenagel reaction

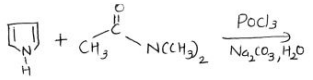
B:-Wolff Kishner reduction

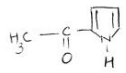
C:-Thorpe reaction

D:-Mannich reaction

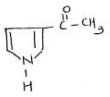
Correct Answer:- Option-B

Question36:-The major product of the following reaction is



A:- 

B:- 

C:- 

D:- 

Correct Answer:- Option-A

Question37:-Which of the following statement is/are correct about nitrene?

i. Nitrene exist as singlet state where nitrogen atom is SP^2hybridised

ii. Nitrene is formed when hydrazoic acid is irradiated with ultraviolet light.

iii. π insertion of nitrene into C =C gives aziridine

A:-only i and ii

B:-only ii and iii

C:-only ii

D:-all of the above statements i, ii and iii

Correct Answer:- Option-D

Question38:-A chemical reaction involves enolizable aldehyde or ketone, secondary amine formaldehyde and catalytic HCl to form product aminoketone. The reaction is called

A:-Thorpe reaction

B:-Heck reaction

C:-Mannich reaction

D:-Peterson reaction

Correct Answer:- Option-C

Question39:-Which of the following statement is/are incorrect about the shapiro reaction?

i. In this reaction ketone is converted to corresponding alkene

ii. Carbocation is the intermediate in shapiro reaction

iii. Ketone is first converted to tosylhydrazone

iv. Carbondioxide gas is evolved during the reaction

A:-only i and ii

B:-only iii and iv

C:-only ii, iii and iv

D:-only ii and iv

Correct Answer:- Option-D

Question40:-Which of the following reaction gives cyclic β ketoester is the final product?

A:-Dieckmann condensation

B:-Chugaev reaction

C:-Julia olefination

D:-Thorpe reaction

Correct Answer:- Option-A

Question41:-Curtius rearrangement involves the decomposition of

A:-Azides

B:-Diazonium salts

C:-Hydroxylamines

D:-Imines

Correct Answer:- Option-A

Question42:-Favorskii rearrangement occurs in

A:-α-Haloketones with base

B:-Alcohols with HCl

C:-Amines with nitrous acid

D:-Carboxylic acids with H_2SO_4

Correct Answer:- Option-A

Question43:-$NaBH_4$ selectively reduces

A:-Carboxylic acids

B:-Esters

C:-Aldehydes and ketones

D:-Alkenes

Correct Answer:- Option-C

Question44:-Clemmensen reduction works under

A:-Acidic conditions

B:-Basic conditins

C:-Neutral conditions

D:-Photochemical conditions

Correct Answer:- Option-A

Question45:-In Hammett equation, σ represents :

A:-Resonance stabilization only

B:-Steric effect

C:-Solvent polarity

D:-Electronic substituent constant

Correct Answer:- Option-D

Question46:-Taft equation accounts for :

A:-Steric and polar effects

B:-Resonance effects only

C:-Radical stabilization

D:-Hyperconjugation

Correct Answer:- Option-A

Question47:-Heck reaction couples :

A:-Alkyne + Aldehyde

B:-Aryl halide + alkyne

C:-Alkene + ketone

D:-Aryl halide + alkene

Correct Answer:- Option-D

Question48:-Stille coupling involves

A:-Grignards

B:-Organoboron compounds

C:-Organotin compounds

D:-Alkyl lithiums

Correct Answer:- Option-C

Question49:-Tebbe reagent converts :

A:-Ketones → alcohols

B:-Alcohols → alkanes

C:-Esters → acids

D:-Carbonyl compounds → alkenes

Correct Answer:- Option-D

Question50:-Which reagent is used for radical reductions?

A:-Bu_3SnH(tri-n-butyltin hydride)

B:-$LiAlH_4$

C:-$NaBH_4$

D:-DIBAL-H

Correct Answer:- Option-A

Question51:-The incorrect statement about the Jablonski diagram is

A:-Fluorescence occurs from the singlet excited state to the ground state

B:-Intersystem crossing involves a transition between states of different spin multiplicity

C:-Phosphorescence occurs from the singlet excited state directly to the singlet ground state

D:-Non-radiative relaxation includes vibrational relaxation and internal conversion

Correct Answer:- Option-C

Question52:-Which of the following is a **diterpene?**

A:-Menthol

B:-Camphor

C:-Geraniol

D:-Retinol

Correct Answer:- Option-D

Question53:-In the **Paternò-Büchi reaction**, a carbonyl compound reacts with

A:-An alkane to give an ehter

B:-An alkene to give an oxetane

C:-A diene to give a cyclobutane

D:-An arene to give a quinone

Correct Answer:- Option-B

Question54:-Which of the following steroids is a **glucocorticoid hormone**?

A:-Testosterone

B:-Estradiol

C:-Cortisol

D:-Progesterone

Correct Answer:- Option-C

Question55:-Which of the following is the **correct sequence of steps in rational drug design?**

A:-Target identification → Lead identification → Lead optimization → Preclinical studies → Clinical trials

B:-Lead identification → Clinical trials → optimization → Preclinical studies

C:-Clinical trials → Target identification → Optimization → FDA approval

D:-Optimization → Target validation → Preclinical studies → Clinical trials

Correct Answer:- Option-A

Question56:-Which type of electronic transition is responsible for the **strongest absorption in conjugated dienes** in UV spectroscopy?

A:-$\sigma \rightarrow \sigma^*$

B:-$\pi \rightarrow \pi^*$

C:-$n \rightarrow \pi^*$

D:-$n \rightarrow \sigma^*$

Correct Answer:- Option-B

Question57:-A molecular ion peak at **m/z 72** with a base peak at **m/z 43** is most likely due to

A:-Hexane

B:-Acetaldehyde

C:-Cyclohexane

D:-Butanone

Correct Answer:- Option-D

Question58:-In an IR spectrum, a sharp absorption near 1715 $cm^{-1}$is generally assigned to

A:-C=O stretching of a ketone

B:-O–H stretching

C:-C=C stretching of an aromatic ring

D:-C–N stretching of an amine

Correct Answer:- Option-A

Question59:-Match the NMR technique with its use :

1.	DEPT	a.	Detects through-space interactions
2.	COSY	b.	Distinguishes CH, CH_2, CH_3 groups
3.	HSQC	c.	Correlation between coupled protons
4.	NOE	d.	Correlates protons with directly bonded carbons

Options

A:-1-b, 2-c, 3-d, 4-a

B:-1-a, 2-b, 3-c, 4-d

C:-1-d, 2-c, 3-a, 4-b

D:-1-b, 2-d, 3-c, 4-a

Correct Answer:- Option-A

Question60:-In a DEPT-135 spectrum :

A:-All carbons appear positive

B:-Only quaternary carbons appear

C:-Only CH carbons appear positive, others are suppressed

D:-CH and CH_3 signals appear positive, CH_2 signals negative

Correct Answer:- Option-D

Question61:-Equilibrium constant Kp for the decomposition of one mole of water in the vapour state can be

A:-$\frac{\alpha^{\frac{3}{2}}P^{\frac{1}{2}}}{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}$

B:-$\frac{\alpha^{\frac{1}{2}}P^{\frac{3}{2}}}{(1-\alpha)(2+\alpha)^{\frac{3}{2}}}$

C:-$\frac{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}{\alpha^{\frac{3}{2}}P^{\frac{1}{2}}}$

D:-$\frac{\alpha^{\frac{3}{2}}P^{\frac{1}{2}}}{(1-\alpha)^{\frac{3}{2}}(2+\alpha)^{\frac{1}{2}}}$

Correct Answer:- Option-A

Question62:-Which among the following is the correct statement?

A:-The entropy of a monatomic gas predicted by Sackur-Tetrode equation approaches zero as the temperature approaches zero

B:-Sackur-Tetrode equation can be used for assessing the entropy of any ideal gas

C:-Sackur-Tetrode equation expresses the entropy of a monatomic gas in terms of volume, internal energy and the number of particles

D:-Sackur-Tetrode equation deals with the translational and vibrational degrees of freedom of monatomic gaseous molecules only

Correct Answer:- Option-C

Question63:-Total energy predicted by the equipartition principle of a molecule is 6.5 k_BT. Which among the following can be the molecule?

A:-CO_2

B:-CO

C:-Ar

D:-SO_2

Correct Answer:- Option-A

Question64:-The notation $\left(\frac{\partial G}{\partial P}\right)_{T,ni,nj}$ is equal to

A:-–S

B:-μ_j

C:-μ_i

D:-V

Correct Answer:- Option-D

Question65:-What is the variance at the congruent melting points of $FeCl_3$- water system as per the reduced equation of phase rule?

A:-0

B:-1

C:-2

D:-3

Correct Answer:- Option-A

Question66:-Which among the following is not a correct form of Maxwell's relations?

A:-$(\partial H/\partial P)_S=(\partial G/\partial P)_T$

B:-$(\partial U/\partial S)_V=(\partial H/\partial S)_P$

C:-$(\partial S/\partial P)_T=(\partial V/\partial T)_P$

D:-$(\partial A/\partial T)_V=(\partial G/\partial T)_P$

Correct Answer:- Option-C

Question67:-Ionic radii of Mg^{2+} and O^{2-} are 66 pm and 131 pm respectively. Structure of MgO can be

A:-Cesium Chloride structure

B:-Zinc blend structure

C:-Rutile structure

D:-Sodium chloride structure

Correct Answer:- Option-D

Question68:-Which among the following statement in connection with liquid crystals is incorrect?

A:-Transitions related to liquid crystals can be both enantiotropic and monotropic

B:-As pressure is raised, nematic to isotropic transition temperature decreases

C:-Smectic liquid crystals have a layered structure and a restricted mobility

D:-The pitch of the helical structure in cholesteric liquid crustals often varies with temperature

Correct Answer:- Option-B

Question69:-As per the Van der Waal's equation, expression for critical pressure is

A:-$\frac{8a}{27b^2}$

B:-$\frac{8a}{27bR}$

C:-$\frac{a}{27b^2}$

D:-$\frac{a}{27bR}$

Correct Answer:- Option-C

Question70:-What is the approximate temperature at which the root mean square velocity of hydrogen becomes equal to that of nitrogen at 7ºC?

A:-–272 °C

B:-–233 °C

C:-–263 °C

D:-–253 °C

Correct Answer:- Option-D

Question71:-A solid adsorbs 10 mL of N_2 gas at STP. Calculate the surface area of the solid if each N molecule occupies an area of $16.2\times10^{-20}m^2$.
(Avogadro's number = $6\times10^{23}mol^{-1}$, Molar volume 22.4 L)

A:-4.35 m^2

B:-3.45 m^2

C:-34.25 m^2

D:-43.25 m^2

Correct Answer:- Option-D

Question72:-Which of the following microscopy techniques relies on **tunneling current** between tip and sample?

A:-SEM

B:-TEM

C:-STM

D:-AFM

Correct Answer:- Option-C

Question73:-Match the following catalytic theories/mechanisms :

Part A	Part B
a. Langmiur-Hinshelwood	1. Enzyme-substrate complex formation
b. Michaelis-Menten	2. Both reactants absorbed on catalyst surface
c. Eley-Rideal	3. One reactant absorbed, other from bulk phase
d. Lock-and-key model	4. Substrate fits active site with specificity
e. Induced-fit model	5. Active site undergoes conformational change on binding

A:-a-2, b-1, c-3, d-4, e-5

B:-a-3, b-2, c-1, d-5, e-4

C:-a-3, b-3, c-1, d-4, e-5

D:-a-1, b-2, c-3, d-5, e-4

Correct Answer:- Option-A

Question74:-Identify the incorrect statement regarding BET adsorption isotherm :

A:-it explains multilayer adsorption

B:-It reduces to Langmuir equation at very low relative pressure (P/P_0)

C:-It can be used to determine the monolayer capacity of adsorbate

D:-It is valid over the entire range of relative pressures (0<P/P_0 <1)

Correct Answer:- Option-D

Question75:-The slope of a plot of ln k vs 1/T is -5000 K.What is the activation energy (Ea)?

A:-49.52 $kJ \cdot mol_{-1}$

B:-41.57$kJ \cdot mol_{-1}$

C:-55.55 $kJ \cdot mol_{-1}$

D:-$60.00 kJ \cdot mol_{-1}$

Correct Answer:- Option-B

Question76:-The **cage effect** refers to

A:-The effect of ionic strength on reaction rate

B:-The catalytic effect of transition metals

C:-The restriction of reactive species by solvent molecules

D:-The influenced of dielectric constant on solvolysis

Correct Answer:- Option-C

Question77:-Statement : *Auger Electron Spectroscopy (AES) can be used to determine the elemental composition of the top few atomic layers of a solid.* Which of the following options is correct?

A:-True, because Auger electrons orginate from surface atoms

B:-False, because Auger electrons penetrate deep inside the solid

C:-True, but applicable only for insulators

D:-False, because AES measures only molecular vibrations

Correct Answer:- Option-A

Question78:-Match the electroanalytical techniques with its main principle

a Potentiometry 1. Potential measurement without current flow
b. Polarography 2. Measurement of current at a fixed applied potential
c. Coulometry 3. Analysis based on the total charge passed during electrolysis
d. Cyclic voltamettry 4. Study of reversible/irreversible redox mechanism via potential sweeps
e. Conductometry 5. Measurement of conductivity changes during a reaction
f. Amperometry 6. Diffusion-controlled current at a dropping mercury electrode

A:-a-1, b-2, c-3, d-4, e-5, f-6

B:-a-2, b-1, c-3, d-6, e-4, f-5

C:-a-1, b-6, c-3, d-4, e-5, f-2

D:-a-1, b-3, c-2, d-4, e-6, f-5

Correct Answer:- Option-C

Question79:-A colloidal suspension of TiO_2 nanoparticles shows a zeta potential of -35 mV at pH 7. What does this imply and what happens if the pH is adjusted to the isoelectric point (≈pH 6)

A:-The colloid is unstable at -35 mV; stability increases at the isoelectric point

B:-The colloid is stable at -35 mV due to strong repulsion; at the isoelctric point, particles aggregate due to loss of charge

C:-The colloid is stable at -35 mV; stability remains the same even at the isoelectric point

D:-Zeta potential has no role in colloidal stability; aggregation depends only on van der Waals forces

Correct Answer:- Option-B

Question80:-Match the following adsorption isotherm equations with their type

Types of isotherms :

a. $\frac{P}{V(P_o-P)}=\frac{1}{VmC}+\frac{C-1}{VmC}\cdot\frac{P}{P_0}$ 1. BET isotherm

b. $\theta=\frac{KP}{1+KP}$ 2. Langmuir isotherm
c. log x/m = log k + 1/n log P 3. Freundlich isotherm
d. qe = $\frac{RT}{b}$ln ($K_T Ce$) 4. Temkin isotherm
e. ln $q_c=\ln q_m-\beta\ \varepsilon^2$ 5. Dubini-Radushkevich isotherm

A:-a-1, b-2, c-3, d-4, e-5

B:-a-2, b-3, c-1, d-5, e-4

C:-a-3, b-1, c-2, d-4, e-5

D:-a-1, b-3, c-2, d-5, e-4

Correct Answer:- Option-A

Question81:-The *Compton effect* is a phenomenon that cannot be explained by classical mechanics. If the scattering angle $\theta=90°$, what will be the Compton shift (Δλ)?

A:-Δλ=h/mc

B:-Δλ=2h/mc

C:-Δλ=0

D:-Δλ=h/2mc

Correct Answer:- Option-A

Question82:-In quantum mechanics, the commutator of position and momentum operators $[\hat{x},\hat{P}_x]$will be equal to

A:-0

B:-$i\hbar$

C:-$-i\hbar$

D:-$\hbar$

Correct Answer:- Option-B

Question83:-An electron is confined in 1D-box with edge length (*a*). If edge length is reduced to (*a*/2), the energy of electron will be

A:-doubled

B:-remains the same

C:-reduced to half

D:-Increased four times

Correct Answer:- Option-D

Question84:-Consider the following molecules and ions
i. CO
ii. NO
iii. NO^+
iv. O_2^{2-}
Which of these species are associated with similar value of their bond order?

A:-only i and ii

B:-only i and iii

C:-only iii and iv

D:-only ii and iv

Correct Answer:- Option-B

Question85:-The ground state term symbols of ferrous (Fe^{2+}) and ferric (Fe^{3+}) ions are respectively

A:-^4F and ^6S

B:-^6S and ^5D

C:-^5D and ^6S

D:-^5D and ^4F

Correct Answer:- Option-C

Question86:-The Hartree-Fock approach belongs to which of the following computational method?

A:-Semi-empirical

B:-Molecular mechanics

C:-Coupled - cluster calculation

D:-Ab initio

Correct Answer:- Option-D

Question87:-According to Kopp's law, the molecular heat capacity of a solid compound is approximately equal to

A:-Geometric mean of atomic heat capacities of constituent elements

B:-Sum of atomic heat capacities of constituent elements

C:-Twice the sum of atomic heat capacities of constituent elements

D:-Product of atomic heat capacities of constituent elements

Correct Answer:- Option-B

Question88:-Which of the following statements are *incorrect?*
i. The number of irreducible representations equals the number of classes
ii. Irreducible representations are not orthogonal to each other
iii. The total number of symmetry operations in the group is called the order of the group
iv. All groups not include a totally symmetric representation

A:-only ii and iv

B:-only i and iii

C:-only ii and iii

D:-only i and iv

Correct Answer:- Option-A

Question89:-The most populated rotational level ($J_{\max}$)of a rigid diatomic molecule is related to absolute temperature (T) as

A:-$J_{\max} \propto \frac{1}{T}$

B:-$J_{\max} \propto T$

C:-$J_{max} \propto \sqrt{T}$

D:-$J_{max} \propto \frac{1}{\sqrt{T}}$

Correct Answer:- Option-C

Question90:-In the rotation-vibration spectrum of a diatomic molecule, the P-branch and R-branch lines corresponding to

A:-ΔJ=+1 and ΔJ=−1 respectively

B:-ΔJ=-1 and ΔJ=0 respectively

C:-ΔJ=0 and ΔJ=+1 respectively

D:-ΔJ=-1 and ΔJ=+1 respectively

Correct Answer:- Option-D

Question91:-What is the result of 13.11+0.3, rounded to the correct number of significant figures?

A:-13.4

B:-13.40

C:-13.41

D:-13.5

Correct Answer:- Option-A

Question92:-In a thermochemical experiment, the enthalpy of neutralization of a strong acid and a strong base is approximately

A:-13.7 kJ/mol

B:-–57.3 kJ/mol

C:-−13.7 kJ/mol

D:-100 kJ/mol

Correct Answer:- Option-B

Question93:-In reverse-phase HPLC, the stationary phase is

A:-Polar

B:-Neutral

C:-Non-polar

D:-Charged

Correct Answer:- Option-C

Question94:-Ionic liquids are considered green solvents mainly because they

A:-Are highly volatile

B:-Evaporate quickly, reducing reaction time

C:-Are cheap and toxic

D:-Are non-volatile and recyclable

Correct Answer:- Option-D

Question95:-Which nanomaterial is used in sunscreens due to its UV-Blocking

ability?

A:-Gold nanoparticles

B:-Zinc oxide nanoparticles

C:-Carbon nanoparticles

D:-Silver nanowires

Correct Answer:- Option-B

Question96:-In green synthesis of nanoparticles, which of the following components in plant extract often acts as a reducing agent?

A:-Alkaloids

B:-Proteins

C:-Polyphenols

D:-Starch

Correct Answer:- Option-C

Question97:-Piezoelectric sensors convert

A:-Mechanical signals into electrical signal

B:-Chemical energy into mechanical energy

C:-Electrical energy into thermal energy

D:-Light into electrical energy

Correct Answer:- Option-A

Question98:-Cyclophanes are important in supramolecular chemistry because

A:-They are inert and do not interact with other molecules

B:-They polymerize to form plastics

C:-They are used as catalysts in all reactions

D:-They serve as hosts for guest molecules due to their cavity-like structure

Correct Answer:- Option-D

Question99:-The elution of proteins in ion exchange chromatography is typically achieved by

A:-Changing temperature

B:-Increasing salt concentration or changing pH

C:-Changing the flow rate

D:-Adding organic solvent

Correct Answer:- Option-B

Question100:-Which of the following is a common type of phase transfer catalyst?

A:-Crown ethers

B:-Alkali metals

C:-Metal oxides

D:-Alkyl halides

Correct Answer:- Option-A