Time: Hours [Total Marks: 50]

Instructions:

1. Fill up the details of the examination on the answer book.
2. There are two sections A and B in the question paper having total 35 questions.
3. Each question has only one correct answer.
4. Select proper option to mark the statement correct.
5. Give your answer in OMR answer-sheet given to you.
6. 0.25 marks for each mark will be deducted for each wrong answer. i.e. 0.25 mark for question of 1 mark and 0.5 mark for question of 2 marks.

SECTION - A: Q. 1 to 20 Multiple Choice Questions: (1 mark)
SECTION - B: Q. 21 to 35 Multiple Choice Questions: (2 marks)

O.M.R. Sheet बरवा अंगणी अगरणी सूजनावां अपेक्षा
O.M.R. Sheet-ल पावल ठेव्या घेया.

Important instructions to fill up O.M.R. Sheet is given on back side of the provided O.M.R. Sheet.
1. In the Raman spectrum, the lines scattering with frequencies lower than the original are called _______.

(A) Raman effect  
(B) Stoke lines  
(C) Rayleigh Scattering  
(D) Antistoke lines

2. The spectral lines in rotational spectra are equally spaced with spacing equal to _______.

(A) \( \frac{h^2}{8\pi^2I} \)  
(B) \( \frac{hf}{2\pi I} \)  
(C) \( \frac{h}{8\pi^2IC} \)  
(D) \( \frac{h}{4\pi^2IC} \)
According to quantum theory relation between energy of a photon and its frequency is

(A) Directly proportional

(B) None of these

(C) No relation

(D) Inversely proportional

Which of the following relationship is correct regarding wave length ?

(A) Microwaves < Radio frequency < Visible < Ultraviolet

(B) Visible < Ultraviolet < Radio frequency < Microwaves

(C) Ultraviolet < Visible < Microwaves < Radio frequency

(D) Radio frequency < Microwaves < Visible < Ultraviolet
1/[A] विदुः समयानु आक सुसंधुप लोप तो प्रविष्टानो कम

1/[A] Vs. time is a straight line graph, then the order of the reaction is

(A) 3

(B) 0

(C) 2

(D) 1

6 तापमान आचे प्रविष्टानो ह्या विषाणुनु अस्त्र

(A) अब्धुमशानी संंधाअं वाघारो

(B) सांतां वाघारो

(C) समिश्रकर्षण शक्ति घटे एच

(D) समिश्रकर्षण शक्तिवर वाघे एच

The rate of reaction increases with temperature due to

(A) Increase in collision frequency

(B) Increase in concentration

(C) Decrease in activation energy

(D) Increase in activation energy
7. \[ A_2 + B_2 \rightarrow 2AB \] \text{where} \[ \log K \rightarrow 1/T \text{-ve} \] \text{then} \[ a = \frac{1}{3} \times 10^{-3} \] which to \[ a \text{nd} \] \text{LHS} \text{side} \text{S.D.} \text{decrease} \text{is} \] \text{is} \[ \text{is} \].

\( \text{R}=1.987 \approx 2 \text{ Cal} \)

For a reaction \[ A_2 + B_2 \rightarrow 2AB \], if slope of a graph of \( \log K \rightarrow 1/T \) is \[ \frac{1}{3} \times 10^{-3} \], the energy of activation is \[ \text{______} \].

\( \text{R}=1.987 \approx 2 \text{ Cal} \)

(A) \[ 4.08 \times 10^3 \text{ Cal} \cdot \text{mole}^{-1} \]

(B) \[ 1.54 \times 10^3 \text{ Cal} \cdot \text{mole}^{-1} \]

(C) \[ 3.08 \times 10^3 \text{ Cal} \cdot \text{mole}^{-1} \]

(D) \[ 0.77 \times 10^3 \text{ Cal} \cdot \text{mole}^{-1} \]

8. \[ N_2O_5 \text{ undergoes thermal decomposition,}\]

\[ N_2O_5 \xrightarrow{\text{slow}} NO_2 + NO_3 \]

\[ N_2O_5 + NO_3 \xrightarrow{\text{fast}} 3NO_2 + O_2 \]

\[ 2N_2O_5 ightarrow 4NO_2 + O_2 \]

\[ \text{The thermal decomposition of} \ N_2O_5 \text{ occurs as follow :} \]

\[ N_2O_5 \xrightarrow{\text{slow}} NO_2 + NO_3 \]

\[ N_2O_5 + NO_3 \xrightarrow{\text{fast}} 3NO_2 + O_2 \]

\[ 2N_2O_5 ightarrow 4NO_2 + O_2 \]

Suggest the correct reaction rate expression

(A) \[ \text{rate} = k[N_2O_5]^2 \]

(B) \[ \text{rate} = k[N_2O_5] [NO_3] \]

(C) \[ \text{rate} = k[NO_2] [NO_3] \]

(D) \[ \text{rate} = k[N_2O_5] \]
Pick up the most appropriate choice about the Lambert-Beer’s law.
(A) By increasing the thickness of the absorbing medium absorbance increases.
(B) All of these are correct.
(C) Decrease of intensity of a beam of monochromatic radiation is directly proportional to the intensity of incident radiation.
(D) Decrease of intensity of a beam of monochromatic radiation, with the thickness of the solution is directly proportional to the concentration of solution.

Tick the wrong statement
(A) Quantum energy $= \frac{hc}{\lambda}$
(B) Energy absorbed by a molecule is directly proportional to its wavelength.
(C) Quantum yield $= \frac{\text{No. of molecules reacting chemically}}{\text{No. of quanta absorbed}}$
(D) Quantum efficiency $= \frac{\text{No. of moles reacting chemically}}{\text{No. of einsteins of energy absorbed}}$
11 What is the effect of introducing electron attracting gp. and electron repelling gp in organic substance, on fluorescence?

(A) Electron attracting gp increases the fluorescence while electron repelling gp. decreases the fluorescence
(B) Electron attracting group as well as electron repelling gp. increases the fluorescence
(C) Electron attracting gp. as well as electron repelling gp. decreases the fluorescence
(D) Electron attracting gp. decreases the fluorescence while electron repelling gp. increases the fluorescence

12 \[ \text{In the following reaction Hg is } \] 

\[ \text{Hg} + \text{hv} \rightarrow \text{Hg}^* \]

\[ \text{Hg}^* + \text{H}_2 \rightarrow \text{Hg} + \text{H}_2^* \]

\[ \text{H}_2^* \rightarrow 2\text{H}^0 \]

(A) Photo sensitizer
(B) Phosphorescent subs
(C) Photo inhibitor
(D) Fluorescent subs
13 NaCl ने जलीम द्रवपानु विद्युतविभाजन करता भनती नीपश्च

(A) जलीम उपर ह₂ अनेखण्य उपर O₂

(B) जलीम उपर Na अनेखण्य उपर O₂

(C) जलीम उपर Na अनेखण्य उपर Cl₂

(D) जलीम उपर H₂ अनेखण्य उपर Cl₂

The products of electrolysis of aqueous NaCl solution are

(A) H₂ at cathode and O₂ at anode

(B) Na at cathode and O₂ at anode

(C) Na at cathode and Cl₂ at anode

(D) H₂ at cathode and Cl₂ at anode

14 विद्युतविभाजन करमियाम विद्युतविभाज उपर सुक्त वा भन्ना अन्यनौ जश्वो _______ उपर आधार राखि थाँथौ।

(A) समय

(B) आधारतानी विद्युतसाधन उपर

(C) द्रवपानु तरक्कता

(D) वीजेन्येखण्नी प्रज्ञता

The amount of an ion liberated on an electrode during electrolysis does not depend upon

(A) Time

(B) Electrochemical equivalence of ions

(C) Conductance of the solution

(D) Current strength
20° C equivalent conductance of a 0.1 N solution of an electrolyte is 4.510 mhos cm². The equivalent conductance of this electrolyte at infinite dilution is 300 mhos cm². The degree of the dissociation of the electrolyte is

(A) 0.015
(B) 0.006
(C) 0.66
(D) 0.15

Transport number depends on

(I) Nature of the other ion present in the solution
(II) Amount of current passed
(III) Degree of hydration of ions
(IV) Duration of time
(V) Effect of temperature

(A) II, III, IV
(B) I, II, IV
(C) I, III, V
(D) II, IV, V
17. The correct expression in SI system relating the equivalent conductance ($\lambda_e$), specific conductance (K) and equivalent concentration (C) is

(A) $\lambda_e = \frac{K \times 100}{C}$

(B) $\lambda_e = \frac{K \times 10^{-6}}{C}$

(C) $\lambda_e = \frac{K}{C}$

(D) $\lambda_e = \frac{K \times 10^{-3}}{C}$

18. From a moving boundary method, the transport no. of H$^+$ ion has been found to be 0.8304 in HCl solution. The transport no. of Cl$^-$ ion is

(A) 0.1696

(B) 0.2696

(C) 1.8304

(D) 1.2696

19. Absorption spectrum in UV region results from ___________.

(A) decrease in rotational energy

(B) increase in potential energy

(C) electronic transition

(D) increase in vibrational energy

20. Which of the following diatomic molecules will not give a rotational spectrum?

(A) N$_2$

(B) CO

(C) NO

(D) HF
21. HCl, the polar molecule, has a permanent dipole. The value of its dipole moment is $2.7 \times 10^{-10}$ As. The bond length of HCl is
(A) 2.29 μm
(B) 1.29 μm
(C) 1.29 Å
(D) 2.29 nm

22. Dipolar molecule absorbs at 2652 cm$^{-1}$. The moment of inertia of the molecule is $1.653 \times 10^{-35}$ kg m$^2$. The reduced mass is $1.653 \times 10^{-25}$ kg. The force constant will be
(A) $4.128 \times 10^6$ dyne cm$^{-1}$
(B) 412.8 N m$^{-1}$
(C) 4.128 N m$^{-1}$
(D) 412.8 dyne cm$^{-1}$

23. What is the frequency of vibration of H$_2$O?
(i) Diatomic molecules absorb at 2652 cm$^{-1}$, and the reduced mass is $1.653 \times 10^{-25}$ kg. The force constant is $4.128 \times 10^6$ dyne cm$^{-1}$.
(ii) The force constant is $4.128 \times 10^6$ dyne cm$^{-1}$, and the reduced mass is $1.653 \times 10^{-25}$ kg. The moment of inertia is $1.653 \times 10^{-25}$ kg m$^2$.
(iii) The moment of inertia is $1.653 \times 10^{-25}$ kg m$^2$, and the reduced mass is $1.653 \times 10^{-25}$ kg. The force constant is $4.128 \times 10^6$ dyne cm$^{-1}$.
(iv) The reduced mass is $1.653 \times 10^{-25}$ kg, and the moment of inertia is $1.653 \times 10^{-25}$ kg m$^2$.
(A) (i) T, (ii) F, (iii) F, (iv) T
(B) (i) F, (ii) F, (iii) T, (iv) F
(C) (i) F, (ii) T, (iii) F, (iv) T
(D) (i) T, (ii) F, (iii) T, (iv) T
24. In Raman spectrum when incident frequency is greater than that of scattered it is known as _______ while if the incident frequency is smaller than that of scattered it is known as _______.

(A) stoke lines, antistoke lines
(B) maximum absorption, minimum absorption
(C) Raman frequency, Raman effect
(D) antistoke lines, stoke lines

25. The vibrational transitions in polyatomic molecules occur between
\[ \nu \rightarrow \nu \] and \[ \nu \rightarrow \nu \] and are called as _______ and _______ respectively.

(A) Main band, subsidiary band
(B) Overtone, supportive band
(C) Overtone, Fundamental band
(D) Fundamental band, overtone
26. The rate constant of a reaction at 50°C and 100°C are 1.5 × 10^7 sec⁻¹ and 4.5 × 10^7 sec⁻¹ respectively. Energy of activation is
(A) \( E_a = 2.2 \times 10^8 \text{ J\cdot mole}^{-1} \)
(B) \( E_a = 1.1 \times 10^8 \text{ J\cdot mole}^{-1} \)
(C) \( E_a = 2.2 \times 10^4 \text{ J\cdot mole}^{-1} \)
(D) \( E_a = 1.1 \times 10^4 \text{ J\cdot mole}^{-1} \)

27. For the decomposition of a compound AB at 600 K, following data were obtained

<table>
<thead>
<tr>
<th>Concentration of AB (M)</th>
<th>Rate of decomposition (M·s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.20</td>
<td>2.75 × 10⁻⁸</td>
</tr>
<tr>
<td>0.40</td>
<td>11.00 × 10⁻⁸</td>
</tr>
<tr>
<td>0.60</td>
<td>24.75 × 10⁻⁸</td>
</tr>
</tbody>
</table>

For AB, the order of reaction is
(A) 2
(B) 3
(C) 0
(D) 1

28. Frequency and wave number for ultraviolet radiations with wavelength of 2000 Å are ______ and ______ respectively.
(A) \( 1.5 \times 10^{12} \text{ sec}^{-1}, 5.0 \times 10^5 \text{ cm}^{-1} \)
(B) \( 1.0 \times 10^{14} \text{ sec}^{-1}, 5.5 \times 10^4 \text{ cm}^{-1} \)
(C) \( 1.0 \times 10^{15} \text{ sec}^{-1}, 5.5 \times 10^4 \text{ cm}^{-1} \)
(D) \( 1.5 \times 10^{15} \text{ sec}^{-1}, 5.0 \times 10^4 \text{ cm}^{-1} \)

29. Values of quantum efficiency of primary and secondary process of photochemical reactions are ______ and ______ respectively.
(A) < 1, 1
(B) > 1, < 1
(C) < 1, > 1
(D) 1, > 1
(i) Nuclear chemistry and testing of radioactive decay

(ii) Testing analysis in urology and separation of Nicotine and Nor-nicotine

(A) (i) Chemiluminescence (ii) Fluorescence

(B) (i) Fluorescence (ii) Phosphorescence

(C) (i) Phosphorescence (ii) Fluorescence

(D) (i) Phosphorescence (ii) Chemiluminescence
AgNO₃ ना द्रव्यमाण Ag⁺ आणणार्या वहनांक 0.482 ए. अनंत मंडळे AgNO₃ ना
द्रव्यमाणी तुव्वूबाळकता 120 म्होस·सेमी²·टुव्वूबाळक⁻¹ ए. NO₃⁻ आणणाऱ्या आणणिक वधन ए.

The transport no. of Ag⁺ ion in solution of AgNO₃ is 0.482. The equivalent
conductance of AgNO₃ solution at infinite dilution is 120 mhos·cm²·equi⁻¹.

Ionic mobility of NO₃⁻ is -

(A) 6.44 ×10⁻⁴ cm²·v⁻¹·s⁻¹

(B) 3.22 ×10⁻⁴ cm²·v⁻¹·s⁻¹

(C) 5.44 ×10⁻⁴ cm²·v⁻¹·s⁻¹

(D) 6.44 ×10⁻⁵ cm²·v⁻¹·s⁻¹

33 अनंत मंडळे Na⁺ अने CI⁻ आणणार्या आणणिक वधनांता अनुसूची 50.11 अने
76.32 म्होस·सेमी²·टुव्वूबाळक ए. Na⁺ अने CI⁻ आणणाऱ्या वहनांक

Ionic conductances of Na⁺ and CI⁻ ions at infinite dilutions are 50.11 and
76.32 mhos·cm²·equi⁻¹ respectively. Transport no. of Na⁺ and CI⁻ ions are

(A) t₊ = 0.452, t₋ = 0.548

(B) t₊ = 0.396, t₋ = 0.604

(C) t₊ = 0.372, t₋ = 0.628

(D) t₊ = 0.421, t₋ = 0.579
34. The effect of increasing temperature on conduction in metallic and electrolytic conductors is as follows:

(A) Metallic and electrolytic conduction decreases
(B) Metallic and electrolytic conduction increases
(C) Metallic conduction increases, electrolytic conduction decreases
(D) Metallic conduction decreases, electrolytic conduction increases

35. Fill in the blanks.

(i) The function of 96500 in the value of Faraday is ______.

(ii) The resistance ______ is used to measure electrolytic conductance.

(A) (i) Faraday's constant (ii) 1/2 mole
(B) (i) Faraday's constant (ii) 2 mole
(C) (i) Faraday's constant (ii) 1 mole
(D) (i) Faraday's constant (ii) 1 mole

(i) Equivalent weight of a substance divided by 96500 gives ______ of the substance.

(ii) One Faraday is the electric charge present on ______ of electrons.

(A) (i) Electrochemical equivalent (ii) 1/2 mole
(B) (i) Molar conductance (ii) 2 mole
(C) (i) Electrochemical equivalent (ii) 1 mole
(D) (i) Equivalent conductance (ii) 1 mole