BYJU'S EXAM PREP

Important Questions on Physical Chemistry- Part V

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Important Questions of Physical Chemistry-Part V

1. $2A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B$

$k_1 = 4\ s^{-1}$

$k_2 = 6\ s^{-1}$

Calculate the relaxation time given that equilibrium concentration of A is 0.4 M and the initial concentration of A is 1M.

A. 0.064 B. 0.032

C. 0.071 D. 0.059

2. Calculate the vibrational degree of freedom for Anthracene molecule.

A. 66 B. 23

C. 60 D. 50

3. 1×10^{-6} moles of the enzymes carbonic anhydrase dehydrate H_2CO_3 and produces 0.6 mol of CO_2 per second. Calculate the turnover number of the enzyme.

A. 6×10^5 B. $\left(\frac{1}{6}\right)\times10^{-4}$

C. $N_A\times 6\times10^{-8}$ D. $(6\times10^2)/N_A$

4. It is given that a sodium contains 2g of anhydrous $BaCl_2$ in 4000 c.c of water has a specific conductivity 0.0058 ohm^{-1}. Calculate the molecular conductivity of this solution.

A. 240 ohm^{-1} c.c. B. 24.1 ohm^{-1} c.c.

C. 2.41 ohm^{-1} c.c. D. 2410 ohm^{-1} c.c.

5. Maximum degree of freedom for two component system is:

A. 5 B. 1 C. 2 D. 3

6. In what condition the real gas equation follows an ideal gas equation?

A. high pressure, high temperature, and low density

B. low pressure, high temperature, and low density

C. low pressure, low temperature, and low density

D. low pressure, high temperature, and high density

7. Phosphorus pentachloride, PCl_5 is a trigonal bipyramidal molecule. To what point group does it belong?

A. D_{3v} B. D_{3h} C. C_{3h} D. D_{5h}

8. If the difference between 2 maxima in the vibrational rotational spectrum is 360 cm^{-1}, then what will be the value of J_{max} If B= 10 cm^{-1} under rigid rotor approximation?

A. 1 B. 8 C. 10 D. 12

9. A particle in 1-D box of length 1.20 Å. The wavelength associated with it in its ground state is

A. 2.4 nm B. 0.24 nm C. 24 nm D. 0.024 nm

10. Which of the following is the correct statement about amorphous Solid?

A. The constituent particle is arranged in regular fashion.

B. Regular Shape

C. They are Isotropic

D. They have Sharp melting point

Answer Key

1. A	2. A	3. A	4. D	5. D	6. B	7. B
8. B	9. B	10. C				

Solutions

Solution 1.

Relaxation time = $\frac{1}{k_1(4A_e)+k_2}$

$2A \rightleftharpoons B$

t = 0 1 0

t = t_{eq} 1-x_e x_e

x_e = 0.4 M; A_e = 1 – 0.4 = 0.6

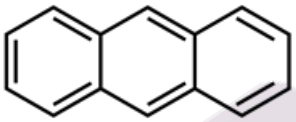
$k_1 = 4\ ;\ k_2 = 6$

Relaxation time = $\frac{1}{k_1[4A_e]+k_2} = \frac{1}{4[4\times 0.6]+6}$

= 1/15.6= 0.064

Solution 2.

The structure of anthracene is:



Vibrational degree of freedom = (3N - 6)

N = 24

Vibrational degree of freedom = 3(24) – 6

= 66

Solution 3.

Turnover number: Number of molecules converted in unit time by one molecule of enzyme.

$H_2CO_3 \xrightarrow{\text{enzyme}} \underset{0.6\,\text{mol}}{H_2O + CO_2}$

Since 10^{-6} N_A mol of enzyme converted 0.6 = N_A mole of H_2CO_3

So, 1 mole of enzyme converted $\frac{0.6\ N_A}{10^{-6} N_A} = 0.6\times 10^6 = 6\times 10^5$

Solution 4.

Molecular conductance Λ = specific conductance, LS/concentration in equivalents/litre, C

$C = \frac{2g}{4\ \text{litre}} \times \frac{1}{200g/eq}$

= 0.0025 eq/litre

$\Lambda = \frac{1000(0.0058)}{0.0025}$

= 2410 ohm^{-1} c.c.

Solution 5.
From Gibbs phase rule:
F = C – P + 2
Here, no. of component = 2
For maximum F, phase should be minimum, therefore, P = 1
$F_{max.}$ = -1 + 2 + 2
$F_{max.}$ = 3
Maximum degree of freedom for 2 component system = 3

Solution 6.
Generally, a gas behaves more like an ideal gas at higher temperature and lower pressure. Since, at high temperature and low pressure, the gas expands enormously which results in an increase in volume, but mass remains the same. Hence, a gas should be of low density.

Solution 7.
PCl_5 has trigonal bipyramidal molecular geometry and it contains a C_3 main rotation axis and 3 perpendicular C_2 axes. There are 3 σ_v planes and a σ_h plane. Hence PCl_5 belongs to the D_{3h} point group.

Solution 8.
$\Delta E = 4B (J_{max} + 1)$
$\Delta E = 4 \times 10 (J_{max} + 1)$

$$\frac{360}{40} = J_{max} + 1$$

$$J_{max} = 8$$

Solution 9.
Wavelength associated with a particle in 1-D box = 2L/n
= (2×1.20)/1 = 2.4 Å
$=2.4\times10^{-10}$ m
=0.24 nm

Solution 10.
An amorphous solid is anyone-glasslike solid that doesn't arrange the atoms and particles in a positive cross-section pattern. There are plastic, glass, and gel solids. Amorphous solids are isotropic. That is, they exhibit uniform properties in all directions. The thermal and electrical conductivities, coefficient of thermal expansion and refractive index of an amorphous solid have the same value in whatever direction the properties are measured.
Properties of Amorphous Solids are:
1. Absence of Long - Range Order
2. No Sharp Melting Point
3. Conversion into a Glasslike Form

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