CHEMISTRY MODEL TEST PAPER

Q.1 The major product formed in the following reaction K + O2 → is
(A) K2O
(B) K2O2
(C) KO2
(D) K2O3

Q.2 The structure of $[XeF_8]^{2-}$ is
(A) cubic
(B) hexagonal bipyramid
(C) square antiprism
(D) octagonal

Q.3 Among the following, the compound that forms the strongest hydrogen bond is
(A) HF
(B) HCl
(C) HBr
(D) HI

Q.4 Among the following, the biomolecule with a direct metal-carbon bond is
(A) coenzyme B_{12}
(B) nitrogenase
(C) chlorophyll
(D) haemoglobin

Q.5 For the reaction $H_2PO_2^-$ (aq) + OH^- (aq) → HPO_3^{2-} (aq) + H2 (g)
The rate expression is $k[H_2PO_2^-] + [OH^-]^2$. If the concentration of $H_2PO_2^-$ is doubled, the rate is
(A) tripled
(B) halved
(C) doubled
(D) unchanged

Q.6 The force constant for $H^{35}Cl$ and $D^{35}Cl$ are the same and both can be considered as harmonic oscillators. H35Cl has a fundamental vibrational transition at 2886 cm^{-1} . The ratio of the zero-point energy of $H^{35}Cl$ to that of $D^{35}Cl$ is
(A) 0.515
(B) 0.717
(C) 1.395
(D) 1.946

Q.7 The geometries of the species $[Br_3]^+$, $[Br_3]^-$ and $[BrF_3]$ are, respectively,
(A) linear, trigonal bipyramidal and trigonal bipyramidal
(B) linear, linear and trigonal planar
(C) tetrahedral, trigonal bipyramidal and trigonal bipyramidal
(D) tetrahedral, trigonal pyramidal and trigonal planar

Q.8 The cage type structure adopted by boron hydride, $[B_5H_{11}]$, is
(A) closo
(B) nido
(C) hypo
(D) arachno

Q.9 The coordination number of aluminium ion and the number of bridging hydrogen atoms in $[Al(BH_4)_4]^-$ are, respectively,
(A) 8 and 8
(B) 6 and 6
(C) 4 and 6
(D) 8 and 12

Q.10 The number of d-d transition(s) expected for the complex $[Cu(NH_3)_2(H_2O)_4]^{2+}$ is
(A) 1
(B) 2
(C) 3
(D) 4

Q.11 Which of the following metal(s) is(are) extracted from its(their) sulphide ore(s) by self-reduction/air reduction method?
(A) Cu
(B) Al
(C) Au
(D) Pb

Q.12 In a saturated calomel electrode, the saturation is with respect to
(A) KCl
(B) Hg_2Cl_2
(C) $HgCl_2$
(D) AgCl

Q.13 Consider the following six solid binary oxides: CaO, Al_2O_3, PbO, Cs_2O, SiO_2 and Sb2O3. The pair(s) of ionic oxides is(are)
(A) CaO and Al_2O_3
(B) CaO and PbO
(C) Cs_2O and Al_2O_3
(D) SiO_2 and Sb_2O_3

Q.14 Choose the CORRECT answer(s) with respect to the magnesium-EDTA titration carried out in the pH range 7 – 10.5, using Solochrome black as indicator
(A) Magnesium–indicator complex is more stable than the magnesium–EDTA complex
(B) At the end point, the colour changes from red to blue
(C) After the end point, the colour of the solution is due to the indicator
(D) pH range of 7 – 10.5 is necessary for observing the specific colour change

Q.15 The CORRECT statement(s) about carbene is(are)
(A) Carbene is a neutral species

(B) Carbene is an intermediate in the Curtius rearrangement
(C) Carbene can insert into both and π-bonds
(D) Carbene is generated from amines on reaction with nitrous acid

Q.16 The ion(s) that exhibit only charge transfer bands in the absorption spectra (UV-visible region) is(are)
(A) $[Cr(C_2O_4)_3]^{3-}$
(B) $[CrO_4]^{2-}$
(C) $[ReO_4]^{-}$
(D) $[NiO_2]^{2-}$

Q.17 The type(s) of interaction(s) that hold layers of graphite together is(are)
(A) π-π stacking
(B) van der Waals
(C) hydrogen bonding
(D) Coulombic

Q.18 TRUE statement(s) about Langmuir isotherm is(are)
(A) valid for monolayer coverage
(B) all adsorption sites are equivalent
(C) there is dynamic equilibrium between free gas and adsorbed gas
(D) adsorption probability is independent of occupancy at the neighbouring sites

Q.19 The $3p_z$ orbital has
(A) one radial node
(B) two radial nodes
(C) one angular node
(D) two angular nodes

Q.20 The diatomic molecule(s) that has(have) two -type bonds is(are)
(A) B_2
(B) C_2
(C) N_2
(D) O_2

Q.21 The total number of optically active isomers of dichlorobis(glycinato)cobaltate(III) ion is _____.

Q.22 The total number of microstates possible for a d 8 electronic configuration is _____.

Q.23 Calcium crystallises in the fcc lattice of unit cell length 5.56 Å and density 1.4848 g cm^{-3} . The percentage of Schottky defects (rounded off to one decimal place) in the crystal is _____.
(Given: Atomic mass of Ca is 40 g mol−1 ; NA = 6.022 x 1023 mol^{-1})

Q.24 A buffer solution is prepared by mixing 0.3 M NH_3 and 0.1 M NH_4NO_3. If K_b of NH_3 is 1.6 x 10^{-5} at 25° C, then the pH (rounded off to one decimal place) of the buffer solution at 25° C is _____.

Q.25 The dissociation constant of a weak monoprotic acid is 1.6 x 10^{-5} and its molar conductance at infinite dilution is 360.5 x 10^{-4} mho m2 mol−1 . For 0.01 M solution of this acid, the specific conductance is n x 10^{-2} mho m^{-1}. The value of n (rounded off to two decimal places) is _____.

Q.26 The ionisation energy of the hydrogen atom is 13.6 eV and the first ionisation energy of the sodium atom is 5.1 eV. The effective nuclear charge experienced by the valence electron of sodium atom is _____. (Round off to one decimal place)

Q.27 One mole of an ideal gas is subjected to an isothermal increase in pressure from 100 kPa to 1000 kPa at 300 K. The change in Gibbs free energy of the system is _____ kJ mol.–1. (Round off to one decimal place)
[Given: Gas constant (R) = 8.3 J K^{-1} mol^{-1}]

Q.28 One litre of an aqueous urea solution contains 6 g of urea. The osmotic pressure of the solution at 300 K (assuming an ideal behaviour) is _____ kPa. (Round off to one decimal place) [Given: Molecular weight of urea is 60, gas constant (R) is 8.3 J K^{-1} mol^{-1}]

Q.29 A first order reflection of X-ray from {220} plane of copper crystal is observed at a glancing angle of 22° . The wavelength of the X-ray used is _____ pm. (Round off to one decimal place) [Given: Copper forms fcc crystal with unit cell edge length of 361 pm.]

Q.30 The collision flux of a monoatomic gas on copper surface is 3.0 10^{18} m^{-2} s^{-1}. Note that the copper surface forms a square lattice with a lattice constant of 210 pm. If the sticking coefficient of the atom with copper is 1.0, the time taken by the gas to form a complete monolayer on the surface is _____ s. (Round off to one decimal place)

ANSWER KEY

Question No.	Question Type (QT)	Subject Name (SN)	Key/Range (KY)	Mark (MK)
1	MCQ	CY	C	1
2	MCQ	CY	C	1

3	MCQ	CY	A	1
4	MCQ	CY	A	1
5	MCQ	CY	C	1
6	MCQ	CY	C	2
7	MCQ	CY	C	2
8	MCQ	CY	D	2
9	MCQ	CY	A	2
10	MCQ	CY	C	2
11	MSQ	CY	A;D	2
12	MSQ	CY	A;B	2
13	MSQ	CY	A;C	2
14	MSQ	CY	B;C;D	2
15	NAT	CY	A;C	2
16	MSQ	CY	B;C	2
17	MSQ	CY	A;B	2
18	MSQ	CY	A;B;C;D	2
19	MSQ	CY	A.C	2
20	MSQ	CY	B;C	2
21	NAT	CY	6	1
22	NAT	CY	45	1
23	NAT	CY	3.9 to 4.1	1

24	NAT	CY	9.7	1
25	NAT	CY	1.44 to 1.47	1
26	NAT	CY	1.7 to 1.9	2
27	NAT	CY	5.6 to 5.8	2
28	NAT	CY	247.0 to 251.0	2
29	NAT	CY	95.0 to 96.0	2
30	NAT	CY	7.5 to 7.7	2