

IIT/EKLAVYA BATCH
THE GURUKUL INSTITUTE

PLOT 5C, 2ND FLOOR, GANAPATI COMPLEX, SEC-13, OPP. JAIPURIA SCHOOL, VASUNDHARA, GHAZIABAD (U.P) PH. NO.9810780903
GURUKUL CHEMISTRY QUIZ -2

TIME: 3 Hr

MM: 134

- A. Q1 to Q30 are multiple choice questions.
- B. Q31 to Q36 are subjective problems.
- C. Q1 to Q9 carry each of 4 marks. 0 marks will be deducted for wrong answer.
- D. Q10 to Q30 carry each of 3 marks. 1 mark will be deducted for each wrong answer.
- E. Q31 to Q35 carry each of 7 marks.

M.C.Q's (More than one may be correct option)

1. The standard reduction potential values of three metallic cations, X, Y, Z are 0.52, -3.03 and -1.18V respectively. The order of reducing power of the corresponding metals is
 - a) $Y > Z > X$
 - b) $X > Y > Z$
 - c) $Z > Y > X$
 - d) $Z > X > Y$
2. For the cell $\text{Co(s)/Co}^{+2}(\text{aq}) (1\text{M})/\text{Ni}^{+2}(\text{aq}) (1\text{M})/\text{Ni(s)}$ at 298 K, the value of the equilibrium constant is 40. It can be deduced that
 - a) Co(s) is a better reducing agent than Ni(s)
 - b) The given cell is feasible at 298 K
 - c) The electrode potential of Co^{+2}/Co is greater than the electrode potential of Ni^{+2}/Ni
 - d) The free energy change is given by the expression $\Delta G^{\circ} = -2.303RT \log 40$
3. Which of the following reductions could be brought about, theoretically, by the element zinc for which the $E_{\text{Zn}^{+2}/\text{Zn}}^{\circ} = -0.76$?
 - a) $\text{V}^{+3} + e^{-} \rightarrow \text{V}^{+2}$ $E^{\circ} = -0.25 \text{ V}$.
 - b) $\text{Al}^{+3} + 3e^{-} \rightarrow \text{Al}$ $E^{\circ} = -1.66 \text{ V}$.
 - c) $\text{Ag}^{+} + e^{-} \rightarrow \text{Ag}$ $E^{\circ} = +0.80 \text{ V}$.
 - d) $\text{Fe}^{2+} + e^{-} \rightarrow \text{Fe}$ $E^{\circ} = -0.44 \text{ V}$.
4. In the electrolysis of Na_2SO_4 solution using inert electrodes,
 - a) The anodic reaction is $2\text{H}_2\text{O} \rightarrow \text{O}_2(\text{g}) + 4e^{-} + 4\text{H}^{+}(\text{aq})$
 - b) $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is produced in a molar ratio 2:1
 - c) 23 grams of sodium is produced at the cathode.
 - d) The cathodic reaction is $\text{Na}^{+} + e^{-} \rightarrow \text{Na}$.
5. Given : $\text{Fe(s)} \rightarrow \text{Fe}^{2+} + 2e^{-}$ $E^{\circ} = +0.44 \text{ V}$
Which of the following metal(s) will oxidize iron?

$\text{Pb(s)} \rightarrow \text{Pb}^{2+} + 2e^{-}$	$E^{\circ} = +0.13 \text{ V}$
$\text{Ag}^{+} + e^{-} \rightarrow \text{Ag}$	$E^{\circ} = +0.80 \text{ V}$
$\text{Cu}^{2+} + 2e^{-} \rightarrow \text{Cu}$	$E^{\circ} = +0.34 \text{ V}$

 - a) Ag
 - b) Cu
 - c) Pb
 - d) None of these.
6. The rate law for the reaction
 $\text{RCl} + \text{NaOH}(\text{aq}) \rightarrow \text{ROH} + \text{NaCl}$
is given by, $\text{Rate} = k_1 [\text{RCl}]$. The rate of the reaction will be
 - a. Doubled on doubling the concentration of sodium hydroxide.
 - b. Halved on reducing the concentration of alkyl halide to one half.
 - c. Increased on increasing the temperature of the reaction.
 - d. Unaffected by increasing the temperature of the reaction.
7. A catalyst

- a. Increases the average kinetic energy of reacting molecules
 - b. Decrease the activation energy
 - c. Alters the reaction mechanism
 - d. Increases the frequency of collisions of reacting species
8. For a first –order reaction
- a. The degree of dissociation is equal to $(1 - e^{-kt})$
 - b. A plot of reciprocal concentration of the reaction versus time gives a straight line.
 - c. The time taken for the completion of 75% reaction is thrice that of $t_{1/2}$ of the reaction.
 - d. The pre–exponential factor in the Arrhenius equation has the dimension of time T^{-1} .
9. Which of the following is (are) correct?
- a. The coordination number of each type of ion in CsCl is 8.
 - b. A metal that crystallizes in bcc structure has a coordination number of 12.
 - c. A unit cell of an ionic crystal shares some of its ions with other unit cells.
 - d. The length of the unit cell in NaCl is 552 pm.
($r_{Na^+} = 95 \text{ pm}, r_{Cl^-} = 181 \text{ pm}$)

M.C.Q's (Only one correct option)

10. For the reaction: $2A + 3B \rightarrow 4C$
The rate of reaction may be represented as
- a. $r = -2 \frac{d[A]}{dt} = -3 \frac{d[B]}{dt} = 4 \frac{d[C]}{dt}$
 - b. $r = -6 \frac{d[A]}{dt} = -4 \frac{d[B]}{dt} = 3 \frac{d[C]}{dt}$
 - c. $r = -\frac{1}{2} \frac{d[A]}{dt} = \frac{1}{3} \frac{d[B]}{dt} = \frac{1}{4} \frac{d[C]}{dt}$
 - d. $r = -\frac{1}{2} \frac{d[A]}{dt} = -\frac{1}{3} \frac{d[B]}{dt} = \frac{1}{4} \frac{d[C]}{dt}$
11. The standard oxidation potentials of the electrodes Ag/Ag^+ , Sn/Sn^{2+} , Ca/Ca^{2+} , Pb/Pb^{2+} are -0.8 , -1.36 , 2.86 and 10.12 V respectively. The most powerful oxidizing agent among these metals is
- a) Pb
 - b) Ca
 - c) Sn
 - d) Ag
12. In the body – centered cubic unit cell of the closest packed atoms, the radius of atom in terms of edge length (a) of the unit cell is
- a) $a/2$
 - b) $a/2\sqrt{2}$
 - c) $\sqrt{3} a/4$
 - d) $4a/\sqrt{3}$
13. The unit cell cube length for LiCl (just like NaCl) is 5.14 \AA . Assuming anion – contact the ionic radius structure for chloride ion is
- a) 1.815 \AA
 - b) 2.57 \AA
 - c) 3.8 \AA
 - d) 4.815 \AA
14. The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is
- a) $LiCl > NaCl > KCl$
 - b) $KCl > NaCl > LiCl$
 - c) $NaCl > KCl > LiCl$
 - d) $LiCl > KCl > NaCl$
15. A solid is made up of two elements X and Z. The atoms Z are in ccp arrangement while atoms X occupy all the tetrahedral voids. What is the formula of the compound?
- a) XZ
 - b) XZ_2
 - c) X_2Z
 - d) X_2Z_3
16. Calculate the standard free energy change in kJ for the reaction: $Cu^+ + I^- \rightarrow CuI$
Given:
- | | |
|--------------------------------|--------------------|
| $CuI + e \rightarrow Cu + I^-$ | $E^\circ = -0.17V$ |
| $Cu^+ + e \rightarrow Cu$ | $E^\circ = 0.53 V$ |
- a) -67.55
 - b) 135.1
 - c) $1.78V$
 - d) $-1.75 V$
17. In electrolysis of alkaline water, a total of 1 mole of gases is evolved. The amount of water decomposed would be
- a) 1 mol
 - b) 2 mol
 - c) $1/3$ mol
 - d) $2/3$ mol
18. How many nearest neighbors are there in an atom or (ion) for an octahedral hole of a close packed structure?

SUBJECTIVE PROBLEMS

31. The rate constant for the first order decomposition of a certain reaction described by the equation : $\log(k/s^{-1}) = 14.34 - (1.25 \times 10^4 K)/T$
- What is the energy of activation of this reaction?
 - At what temperature will its half -life be 256 minutes?
32. An excess of liquid mercury is added to an acidified solution of $1.0 \times 10^{-3} M Fe^{3+}$. It is found that 5% of Fe^{3+} remains at equilibrium at $25^\circ C$. Calculate $E^\circ(Hg_2^{3+}|Hg)$, assuming that the only reaction that occurs is $2Hg + 2Fe^{3+} \rightarrow Hg_2^{3+} + 2Fe^{2+}$. Given: $E^\circ(Fe^{3+}|Fe^{2+}) = 0.77V$.
33. Calculate the percentage of void volume in the (a) primitive, (b) body centered cubic metallic crystals.
34. The standard reduction potential for $Cu^{2+}|Cu$ is $+0.34 V$. Calculate the reduction potential at $pH = 14$ for the above couple in a saturated solution of cupric hydroxide. K_{sp} of $Cu(OH)_2$ is 1.0×10^{-19} .
35. Find the solubility product of a saturated solution of Ag_2CrO_4 in water at $298 K$ if the emf of the cell $Ag | Ag^+ (satd. Ag_2CrO_4 \text{ soln.}) || Ag^+(0.1M) | Ag$ is $0.164 V$ at $298 K$.