

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

- Increases the average kinetic energy of reacting molecules
 - Decrease the activation energy
 - Alters the reaction mechanism
 - Increases the frequency of collisions of reacting species
8. For a first –order reaction
- The degree of dissociation is equal to $(1 - e^{-kt})$
 - A plot of reciprocal concentration of the reaction versus time gives a straight line.
 - The time taken for the completion of 75% reaction is thrice that of $t_{1/2}$ of the reaction.
 - The pre–exponential factor in the Arrhenius equation has the dimension of time T^{-1} .
9. Which of the following is (are) correct?
- The coordination number of each type of ion in CsCl is 8.
 - A metal that crystallizes in bcc structure has a coordination number of 12.
 - A unit cell of an ionic crystal shares some of its ions with other unit cells.
 - 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
- $r = -2 \frac{d[A]}{dt} = -3 \frac{d[B]}{dt} = 4 \frac{d[C]}{dt}$
 - $r = -6 \frac{d[A]}{dt} = -4 \frac{d[B]}{dt} = 3 \frac{d[C]}{dt}$
 - $r = -\frac{1}{2} \frac{d[A]}{dt} = \frac{1}{3} \frac{d[C]}{dt} = \frac{1}{4} \frac{d[C]}{dt}$
 - $r = -\frac{1}{2} \frac{d[A]}{dt} = -\frac{1}{3} \frac{d[C]}{dt} = \frac{1}{4} \frac{d[C]}{dt}$
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
- Pb
 - Ca
 - Sn
 - 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
- $a/2$
 - $a/2\sqrt{2}$
 - $\sqrt{3} a/4$
 - $4a/\sqrt{3}$
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
- 1.815 \AA
 - 2.57 \AA
 - 3.8 \AA
 - 4.815 \AA
14. The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is
- $LiCl > NaCl > KCl$
 - $KCl > NaCl > LiCl$
 - $NaCl > KCl > LiCl$
 - $LiCl > KCl > NaCl$
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?
- XZ
 - XZ_2
 - X_2Z
 - X_2Z_3
16. Calculate the standard free energy change in kJ for the reaction: $Cu^+ + I^- \rightarrow CuI$
Given:
- | | | |
|--|--------------------------------|--------------------|
| | $CuI + e \rightarrow Cu + I^-$ | $E^\circ = -0.17V$ |
| | $Cu^+ + e \rightarrow Cu$ | $E^\circ = 0.53 V$ |
- -67.55
 - 135.1
 - 1.78V
 - $-1.75 V$
17. In electrolysis of alkaline water, a total of 1 mole of gases is evolved. The amount of water decomposed would be
- 1 mol
 - 2 mol
 - $1/3$ mol
 - $2/3$ mol
18. How many nearest neighbors are there in an atom or (ion) for an octahedral hole of a close packed structure?

- a) 4 b) 6 c) 8 d) 12
19. Consider the cell $Zn|Zn^{2+} || Cu^{2+} |Cu$. If the concentration of Zn^{2+} and Cu^{2+} ions are doubled, the emf of the cell.
- a) Doubles b) Reduces half c) Remains same d) becomes zero
20. The equivalent conductance of monobasic acid at infinite dilution is $438 \text{ ohm}^{-1}\text{cm}^2\text{eq}^{-1}$. If the resistivity of the solution containing 15g of acid (Molecular weight = 49) in 1L is 18.5 ohm cm . What is the degree of dissociation of acid?
- a) 45.9% b) 40.2% c) 60.4% d) 50.7%
21. The density of KBr is 2.75 g cm^{-3} . The length of the unit cell is 654 pm. If mass number of K is 39 and that of Br is 80. What is true about the predicated nature of the solid cell?
- a) Solid has fcc System with $Z = 4$.
b) Solid has simple cubic system with $Z = 4$.
c) Solid has fcc system with $Z = 1$.
d) Solid has bcc system $Z = 2$.
22. $TlCl$ exist in a cesium chloride lattice. The number of Cl^- ions present per unit cell equal is
- a) 1 b) 2 c) 4 d) 6
23. In a compound oxide ions have cubic close packing arrangement. Cations A and present in half of the tetrahedral holds and cation B occupy the octahedral holes. The simplest formula of the compound
- a) AB_2O_4 b) A_2BO_4 c) ABO_2 d) ABO
24. In sodium chloride crystal, the number of next nearest neighbors of each Na^+ ions is
- a) 8 Cl^- ions b) 12 Na^+ ions c) 12 Cl^- ions d) 24 Cl^- ions
25. If a is the edge length of unit cell of sodium chloride, the distance between two nearest Na^+ ions is
- a) a b) $\sqrt{2} a$ c) $\sqrt{3} a$ d) $a/\sqrt{2}$
26. For the decomposition of $N_2O_5(g)$, it is given that
- | | | |
|---|--------------------------|----------------------------------|
| $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ | activation energy E_a | |
| $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2} O_2(g)$ | activation energy E'_a | |
| a) $E_a = E'_a$ | b) $E_a > E'_a$ | c) $E_a < E'_a$ d) $E_a = 2E'_a$ |
27. The reaction : $v_1A + v_2B \rightarrow \text{products}$
Is first order with respect to A and zero order with respect to B. If the reaction is started with $[A]_0$ and $[B]_0$, the integrated rate expression of this reaction would be
- | | |
|--|---|
| a) $\ln \frac{[A]_0}{[A]_0 - x} = k_1 t$ | c) $\ln \frac{[A]_0}{[A]_0 - v_1 x} = v_1 k_1 t$ |
| b) $\ln \frac{[A]_0}{[A]_0 - v_1 x} = k_1 t$ | d) $\ln \frac{[A]_0}{[A]_0 - v_1 x} = -v_1 k_1 t$ |
- where v_1 is the extent of reaction divided by constant volume.
28. The activation energy for a reaction which doubles the rate when the temperature is raised from 300K to 310 K is
- a) 50.6 kJ mol^{-1} c) 56.6 kJ mol^{-1}
b) 53.6 kJ mol^{-1} d) 59.6 kJ mol^{-1}
29. A gas X at 1 atm is bubbled through a solution containing mixture of 1 M Y^- and 1M Z^- at $25^\circ C$. if the reduction potential is in the order of $Z > Y > X$ then
- a) Y will oxidize X and not Z c) Y will oxidize both X and Z
b) Y will oxidize Z and not X d) Y will reduce both X and Z
30. What is the charge in coulombs of 1g ion of N^{3-} ?
- a) 2.89×10^5 c) 2.3×10^8
b) 2.6×10^{15} d) 2.89×10^6

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 $298 K$.