Electrochemistry + Chemical Kinetics

1. Compound A is used as a strong oxidizing agent is amphoteric in nature. It is the part of lead storage batteries. Compound A is

   A. Pb_3O_4

   B. $PbSO_4$

   C. $PbSO_4$

   D. PbO_2

2. The product obtained from the electrolytic oxidation of acidified sulphate solution , is

   A. HO_3SOOSO_3H

   B. HO_2SOSO_2H

   C. HSO_4^-

   D. HO_3SOSO_3H

3. Given below are two statements :
   Statements I : The limiting molar conductivity of KCl (strong electrolyte) is higher compared to that of CH_3COOH (weak electrolyte) .

   Statements II : Molar conductivity decreases with decrease in concentration of electrolyte
   In the light of the above statements, choose the most appropriate answer from the options given below :

   A. Statement I is true but Statement II is false

   B. Both Statements I and II are false

   C. Both Statements I and II are true

   D. Statement I is false but Statement II is true

4. Match List-I with List - II

List-I (Parameter)	List-II (Unit)
(a) Cell constant	(i) $S\ cm^2\ mol^{-1}$
(b) Molar conductivity	(ii) Dimensionless
(c) Conductivity	(iii) m^{-1}
(d) Degree of dissociation of electrolyte	(iv) $\Omega^{-1}m^{-1}$

Choose the most appropriate answer from the options given below

A. (a)-(iii) , b-(i) , (c)-(ii), (d)-(iv)

B. (a)-(i) , b-(iv) , (c)-(iii), (d)-(ii)

C. (a)-(ii) , b-(i) , (c)-(iii), (d)-(iv)

D. (a)-(iii) , b-(i) , (c)-(iv), (d)-(ii)

5. The equation that is incorrect is :

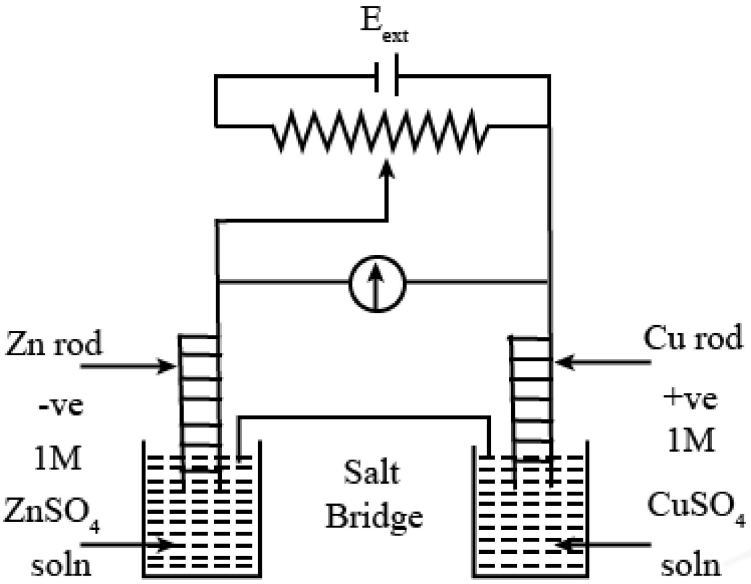
A. $(\Lambda_m^0)_{NaBr} - (\Lambda_m^0)_{NaCl} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{KCl}$

B. $(\Lambda_m^0)_{H_2O} = (\Lambda_m^0)_{HCl} + (\Lambda_m^0)_{NaOH} - (\Lambda_m^0)_{NaCl}$

C. $(\Lambda_m^0)_{NaBr} - (\Lambda_m^0)_{NaI} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{NaBr}$

D. $(\Lambda_m^0)_{KCl} - (\Lambda_m^0)_{NaCl} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{NaBr}$

6.



$E^0_{Cu^{2+}|Cu} = +034\ V$

$E^0_{Zn^{2+}|Zn} = -0.76\ V$

Identify the incorrect statement from the below for the above cell :

A. If $E_{ext} = 1.1\ V$, no flow of e^- or current occurs

B. If $E_{ext} < 1.1\ V$, Zn dissolves at anode and Cu deposits at cathode

C. If $E_{ext} > 1.1\ V$, e^- flow from Cu top Zn

D. If $E_{ext} > 1.1\ V$, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

7. Given that the standard potentials (E^0) of Cu^{2+}/Cu and Cu^+/Cu are $0.34\ V$ and $0.522\ V$ respectively, the E^0 of Cu^{2+}/Cu^+ is-

A. $+0.158\ V$

B. $0.182\ V$

C. $-0.158\ V$

D. $-0.182\ V$

8. Consider the follwoing reduction processes :
$Zn^{2+} + 2e^- \rightarrow Zn(s);\ E^0 = -0.76\ V$
$Ca^{2+} + 2e^- \rightarrow Ca(s);\ E^0 = -2.87\ V$
$Mg^{2+} + 2e^- \rightarrow Mg(s);\ E^0 = -2.36\ V$
$Ni^{2+} + 2e^- \rightarrow Ni(s); E^0 = -0.25\ V$

The reducing power of the metals increases in the order :

A. $Ca < Zn < Mg < Ni$

B. $Ni < Zn < Mg < Ca$

C. $Zn < Mg < Ni < Ca$

D. $Ca < Mg < Zn < Ni$

9. For a reaction of order (n), the unit of the rate constant is :

A. $\text{mol}^{1-n}\ L^{2n}\ s^{-1}$

B. $\text{mol}^{1-n}\ L^{1-n}\ s^{-1}$

C. $\text{mol}^{1-n}\ L^{n-1}\ s^{-1}$

D. $\text{mol}^{1-n}\ L^{1-n}\ s$

10. For the reaction

$2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O(g)$

the observed rate expression is,

rate = $k_f[NO]^2[H_2]$. The rate expression for the reverse reaction is :

A. $k_b\dfrac{[N_2][H_2O]^2}{[NO]^2}$

B. $k_b[N_2][H_2O]$

C. $k_b[N_2][H_2O]^2$

D. $k_b\dfrac{[N_2][H_2O]^2}{[H_2]}$

11. The rate of a certain biochemical reaction at physiological temperature (T) occurs 10^6 times faster with enzyme than without. The change in the activation energy upon adding enzyme is

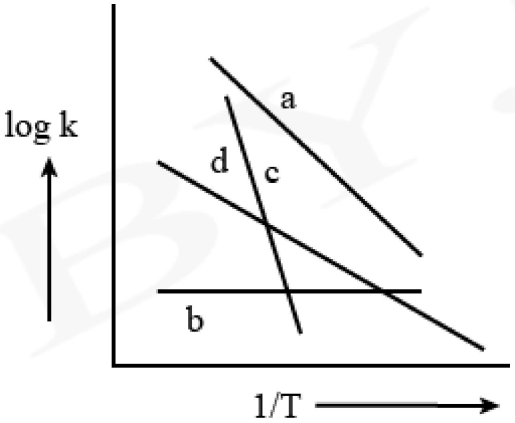
A. $-6RT$

B. $+6RT$

C. $+6(2.303)RT$

D. $-6(2.303)RT$

12. Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. Which of the following orders is correct for the activation energies of these reactions?



A. $E_b > E_a > E_d > E_c$

B. $E_c > E_a > E_d > E_b$

C. $E_a > E_c > E_d > E_b$

D. $E_b > E_d > E_c > E_a$

13. For following reactions

$A \xrightarrow{700\ K}$ Product

$A \xrightarrow[catalyst]{500\ K}$ Product

it was found that the E_a is decreased by $30\ kJ/\text{mol}$ in the presence of catalyst. If the rate remains unchanged, the activation energy for catalysed reaction is (Assume pre exponential factor is same)

A. $75\ kJ/\text{mol}$

B. $198\ kJ/\text{mol}$

C. $105\ kJ/\text{mol}$

D. $135\ kJ/\text{mol}$

14. It is true that

A. A zero order raction is a single step reaction

B. A zero order reaction is a multistep reaction

C. A first order reaction is always a single step reaction

D. A second order reaction is always a multistep reaction

15. If a reaction follows the Arrhenius equation, the plot $ln\ k$ vs $\frac{1}{(RT)}$ gives straight line with a gradient (−y) unit. The energy required to activate the reactant is :

A. yR unit

B. $\frac{1}{R}$ unit

C. -y unit

D. y unit

16. Emf of the following cell at $298\ K$ in Vin $x \times 10^{-2}$.

$Zn|Zn^{2+}(0.1\ M)||Ag^{+}(0.01\ M)|Ag$

The value of x is ____. (Rounded off to the nearest integer)

$[(Given): E^{\theta}_{Zn^{2+}/Zn} = -0.76V; E^{\theta}_{Ag^{+}/Ag} = +0.80V; \frac{2.303RT}{F} = 0.059]$

17. $\mathrm{A}\ 5.0\ \mathrm{m\ mol\ dm^{-3}}$ aqueous soluion of KCI has a conductance of $0.55\ mS$ when when measued in a cell of cell constant $1.3\ cm^{-1}$. The molar conductivity of this solution in $mSm^2\ \mathrm{mol}^{-1}$ is

(Round off to the Nearest Integer)

18. A KCl solution of conductivity $0.14\ Sm^{-1}$ shows a resistance of $4.19\ \Omega$ in a conductivity cell. If the same cell is filled with an HCl solution, the resistance drops of $1.03\ \Omega$. The conductivity of the HCI solution is ____ $\times 10^{-2}\ S\ m^{-1}$. (Round off to the Nearest Integer).

19. For the reaction

$2Fe^{3+}(aq) + 2l^{-}(aq) \rightarrow 2Fe^{2+}(aq) + I_2(s)$

The magnitude of the standard molar free energy

Change, $\Delta_r G^0_m = -$ ___ kJ

(Round off to the Nearest Integer).

$$\begin{bmatrix} E^{o}_{Fe^{2+}/Fe(s)} = 0.440\ V; E^{o}_{Fe^{3+}/Fe(s)} & = -0.036V \\ E^{o}_{I_2/2I^{-}} = 0.539\ V; & F = 96500C \end{bmatrix}$$

20. The molar conductivities at infinite dilution of barium chloride, sulphuric acid and hydrochloric acid are 280, 860 and 426 S $cm^{(2)}\ \mathrm{mol}^{-1}$ respectively. The molar conductivity at infinite dilution of barium sulphate is ___ S $cm^2\ \mathrm{mol}^{-1}$. (Round off to the Nearest Integer)

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21. For an electrochemical cell $Sn(s)|Sn^{2+}\ (aq, 1M)||Pb^{2+}\ (aq, 1M)|Pb(s)$, the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is ____.
(Given : $E^0_{Sn^{2+}|Sn} = -0.14\ V,\ E^0_{Pb^{2+}|Pb} = -0.13\ V,\ \frac{2.303RT}{F} = 0.06$)

22. 108 g of silver (molar mass $108\ g\ mol^{-1}$) is deposited at cathode from $AgNO_3(aq)$ solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is _____ (up to two decimel)

23. An exothermic reaction $X \rightarrow Y$ has an activation energy $30\ kJ\ mol^{-1}$. If energy change ΔE during the reaction is $-20\ kJ$, then the activation energy for the reverse reaction in kJ is _____. (Integer answer)

24. If the activation energy of a reaction is $80.9\ kJ\ mol^{-1}$, the fraction of molecules at $700\ K$, having enough energy to react to form products is e^{-x}. The value of x is _____(Rounded off to the nearest integer)
[Use $R = 8.31\ J\ K^{-1}\ mo1^{-1}$]

25. The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at $300\ K\ is\ 1.0 \times 10^{-3} s^{-1}$ and the activation energy $E_a = 11.488\ kJmol^{-1}$, the rate constant at $200\ K$ is _____ $\times 10^{-5} s^{-1}$ (Round off to the Nearest Integer)

26. $A\ and\ B$ decompose via first order kinetics with half-lives $54.0\ min\ and\ 18.0\ min$ respectively. Starting from an equimolar non reactive mixture of $A\ and\ B$, the time taken for the concentration of A to become $16\ times$ that of B is _____ min. (Round off to the Nearest Integer) Take $\ln 2 = 0.693$.

27. The reaction that occurs in a breath analyser, a device used to determine the alcohol level in a person's blood stream is

$$2K_2Cr_2O_7 + 8H_2SO_4 + 3C_2H_6O \rightarrow 2Cr_2(SO_4)_3 + 3C_2H_4O_2 + 2K_2SO_4 + 11H_2O$$

If the rate of appearence of $Cr_2(SO_4)_3$ is $2.67\ \text{mol min}^{-1}$ at a particular time, the rate of disappearance of C_2H_6O at the same time is in mol min^{-1}.
(Nearest integer)

28. The first order rate constant for the decomposition of $CaCO_3$ at $700\ K$ is $6.36 \times 10^{-3} s^{-1}$ and activation energy is $209\ kJ\ \text{mol}^{-1}$. Its rate constant (in s^{-1}) at $600\ K \text{is} X \times 10^{-6}$. The value of is (Nearest integer)
[Given $R = 8.31\ J\ K^{-1}\text{mol}^{-1}; \log 6.36 \times 10^{-3} = -2.19,\ 10^{-4.79} = 1.62 \times 10^{-5}$

29. For the reaction $A \rightarrow B$, the rate constant $k(\text{s}^{-1})$ is given by

$$\log_{10}\ k = 20.35 - \frac{(2.47 \times 10^3)}{T}$$

The energy of activation in kJ mol^{-1} is
(Nearest integer)

[Given : R=8.314 $\text{JK}^{-1}\text{mol}^{-1}$]

30. During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If 1 μg of $^{90}Sr$was absorbed in the bones of a newly born baby in place of Ca, how much time, in years (nearest integer), is required to reduced it by 90% if it is not lost metabolically