CHEMISTRY

BOOKS - GRB CHEMISTRY (HINGLISH)

ELECTROCHEMISTY

Galvanic Cell and Salt Bridge

1. In a galvanic cell

A. chemical reaction produces electrical energy

B. electrical energy produces chemical reaction

C. reduction occurs at anode

D. oxidation occurs at cathode

Answer: A

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2. Which of the following is //are function (s) of salt bredge ?

A. It completes the electrical circuit with electrons flowing from one electrode to the other through external wires and a flow of ions between the two compartments through salt-bridge.

B. It minimizes the liquid-liquid junctioni potential.

C. Both are correct.

D. None of the above.

Answer: C

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3. Salt bridge contains:

A. Calomel

B. corrosive sublimate

C. H^2O

D. agar-agar paste

Answer: D

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4. Saturated solution of KNO_3 is used to make "salt bridge" because .

A. velocity of K^+ is greater than that of NO^{-+}

B. velocity of NO^{-+} is greater than thaat of K^+

C. velocity of both K^+ and NO^{-3} are nearly the same

D. KNO_3 is high soluble in water

Answer: C

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5. When the electric current is passed through a cell having an electrolyte, the positive ions move towards cathode and negative ions toqards the anode. If the cathode is pulled out of the solution .

A. the positive and negative ions will move towards anode

B. the positivie ions will start moving towards the anode while negative ions will stop moving.

C. the negative ions will continue to move towards anode whie positive ions will stop moving

D. the positive and negative ions will start moving randomly

Answer: D

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6. Which of the following statements is true for an electrochemical cell of Cu-H_2?

A. H_2 is anode an Cu is cathode

B. H_2 is cathode and Cu is anode

C. Reduction occurs at H_2 electrode

D. Oxidation occurs at Cu electode

Answer: A

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7. Which of the following statement is true for the electrochemical Daniell cell ?

A. Electrons flow from copper electrode to zinc electrode

B. Current flows from zinc electrode to copper electrode

C. Cations move toward copper electrode

D. Cations move toward zinc electrode

Answer: C

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8. Which of the following is not true about emf of a cell?

A. Work calcualted from it is not the maximum work obtainable from the cell

B. It is maximum voltage obtainable from the cell

C. It is potential difference between two electrodes when no current is flowing in circuit

D. It is responsible for the flow of steady current in the cell

Answer: A

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9. The difference between the electrode potentials of two electrons when no current is drawn through the cell is called:

A. cell potential

B. cell emf

C. potential difference

D. cell voltage

Answer: A::B::C::D

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10. What is correct for working Galvanic cell?

A. Anode is negative electrode

B. Current flows from anode to cathode in outer circuit

C. Electrons flow from anode to cathode through solution

D. $E_{cell} = -ve$

Answer: A

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11. Correct statements about a voltage (galvanic) ell include which of the following?

(P) Oxidation occurs at the anode.

(Q) Electrons flow from the cathode at the anode.

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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12. In electrochemical cells, cathode is always the electrode where:

A. oxidation occurs

B. reduction occurs

C. positive ions are formed

D. negative ions are formed

Answer: B

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13. Which change could occur at the anode of an electrochemical cell?

A. $Cl^- \rightarrow Cl^2$

B. $H_2O \rightarrow H_2$

C. $Na^+ \rightarrow Na$

D. $O_2 \rightarrow H_2O$

Answer: A

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14. Which occurs at the anode of any voltaic cell?

P) A metal electrode dissolves

Q) A substance undergoes oxidation.

R) Positive ions are deposited from the solution

A. P only

B. Q only

C. P and Q only

D. P and R only

Answer: B

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15. In an operating voltaic cell electrons move through the external circuit and ions both move through the electrolyte solution. Which element describes these movements?

A. Electrons and negative ions both move toward the anode

B. electrons and negative ions both move toward the cathode.

C. Electrons move toward the anode and negative ions move toward the cathode.

D. Electrons move toward the cathode and negative ions move toward the anode.

Answer: D

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16. E.m.f of the cell

$2Ag^{+} + Cu \rightarrow Cu^{+2} = 2Ag$

[Given : E° = -0.8V , $E^{\circ}_{Cu^{+2}}$ Cu = 0.3V]`

A. $-0.5V$

B. $0.5V$

C. $-1.1V$

D. $1.1V$

Answer: B

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17. Consider the cell potentials $E^0_{Mg^{2+} | Mg} = -2.37V$ and $E^0_{Fe^{3+} | Fe} = -0.04V$

The best reducing agent would be

A. Mg^{2+}

B. Fe^{3+}

C. Mg

D. Fe

Answer: C

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18. If a spoon of copper metal is placed in a solution of ferrous sulphate .

A. Cu will precipitate

B. iron will precipitate

C. Cu and Fe will precipitate

D. no reaction will take place

Answer: D

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19. The position of some metals in the electrochemical series in dectreasing electropositeve character is given as $Mg > Al > Zn > Cu > Ag$. What will happen if a copper spoon is used to stir a solution of aluminimum nitrate ?

A. The spoon will get coated with aluminium

B. An alloy of aluminium and copper is formed

C. The solution becomes blue.

D. There is no reaction.

Answer: D

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20. Given : $E^{\circ}\left(Cu^{2+/Cu}\right.$ = 0.337V and E^(@) (Sn^(2+//Sn) = -0.136V`.

Which of the following statements is correct?

A. Cu^{2+} ions can be reduced by $H_2(g)$

B. Cu can be oxidized by H^{+}

C. Sn^{2+} ions can be reduced by $H^{2}(g)$

D. Cu can reduce Sn^{+}

Answer: A

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21. Red hot carbon will remove oxygen from the oxides XO and Yo but not from $ZO. Y$ will remove oxygen from XO. Use this evidence to deduce the order of activity of the three metals $X, Y,$ and $Z,$ putting the most reactive first.

A. AgtBgtm

B. BgtAgtM

C. MgtBgtA

D. MgtAgtB

Answer: C

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22. The standard electrode potentials (reduction) of $Pt / Fe^{3+}, Fe^{+2}$ and $Pt / Sn^{4+}, Sn^{+2}$ are $+0.77V$ and $0.15V$ respectively at $25^{\circ} C$. The standard EMF of the reaction $Sn^{4+} + 2Fe^{2+} \rightarrow Sn^{2+} + 2Fe^{3+}$ is

A. $-0.62V$

B. $-0.92V$

C. $+0.31V$

D. $+0.85V$

Answer: C

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23. A gas Cl^2 at atm is bubbled through a solution containing a mixture of $1MBr^-$ and $1MF^-$ at 25°C. If the reductioni potential order is F gt Cl gtBr, then:

A. Cl will oxidise Br and not F

B. Cl will oxidise F and not Br

C. Cl will oxidise both Br and F

D. Cl will reduce both Br and F

Answer: A

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24. The standard reduction potentials of three metals $A, B,$ and C are $+0.5V, -3.0V,$ and $-1.2V$, respectively. The order of reducing power of these metals is

A. B gtCgtA

B. AgtBgtC

C. CgtBgtA

D. AgtCgtB

Answer: A

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25. The $E^{\circ}{}_{\left(\frac{M^{3+}}{M^{2-}}\right)}$ values for Cr, Mn, Fe and Co are $-0.41, +1.567, 0.77$ and $+1.97V$ respectively. For which one of these metals the change in oxidation state from $+2$ to $+3$ is easiest?

A. Cr

B. Mn

C. Fe

D. Co

Answer: A

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26. Consider the following E° values.

$E^\circ_{M^{3+}/M^{2-}}$ values for Cr, Mn, Fe and Co are

$-0.41 Unders\tan dardcondition, thepotentialf \text{ or } thereaction:$ Sn(s)

+ 2Fe^(3+)(aq) rightarrow2Fe^(2+)(aq) + Sn^(2+)(aq)`

A. 1.68V

B. 1.40V

C. 0.91V

D. 0.63V

Answer: A

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27. Standard electrode potential data are useful for understanding the suitability of an oxidant in a redox titration. Some half cell reaction and their standard potentials are given below:

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)E^\circ = 1.51V$

$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l), E^\circ = 1.38V$

$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq), E^\circ = 0.77V$

$CI_2(g) + 2e^- \rightarrow 2CI^-(aq), E^\circ = 1.40V$

Identify the only correct statement regarding quantitative estimation of aqueous $Fe(NO_3)_2$

A. $MnO^{-□}(4)$ can be used in aqueous HCl

B. Cr_2O^{2-7} can be used in aqueous HCl

C. MnO^{-4} can be used in aqueous $H_2SO(4)$

D. Cr_2O^{2-7} can be used in aqueous H^2SO_4

Answer: C

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28. The oxidation ptentials of Zn, Cu, Ag, H_2 and Ni are $0.76, -34, -0.80. 0.00, 0.25$ volt, respectively. Which of the following reactions will provide maximum voltage ?

A. $Zn + Cu^2 \rightarrow Cu + Zn^{2+}$

B. $Zn + 2Ag^+ \rightarrow 2Ag + Zn^{2+}$

C. $H_2 + Ci^{2+} \rightarrow 2H^+ + Cu$

D. $H^2 + Ni^{2+} \rightarrow 2H^+ + Ni$

Answer: B

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29. When iron is rusted, it is

A. reduced

B. oxidized

C. evaporated

D. decomposes

Answer: B

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30. Which statement is correct?

A. In SHE, the pressure of dihydrogen gas should be low and pH of solution should be zero.

B. In the reaction $H^2O_2 + O(3) \rightarrow 2H_2O + 2O_2$, H_2O_2 is oxidised to H_2O.

C. The absolute value of electrode potential cannot be determined.

D. According to IUPAC covention, the standard electrode potential pertains to oxdidation reactioin only.

Answer: C

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31. For $Zn^{2+}/Zn, E^{\circ} = -0.76$, for $Ag^{+}/Ag, E^{\circ} = +0.799V$. The correct statement is

A. The reactioin $\rightarrow$ Zn getting reduced Ag getting oxidized is spontaneous.

B. Zn undergoes reduction and Ag is oxidized.

C. Zn undergoes oxidatioin and Ag^{+} gets reduced.

D. No suitable answer.

Answer: C

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32. Which of the following facts is not truegt

A. if $E^{\circ}\left(M^{n+/M}\right.$ is negative, H^{+} will be reduced to H^{2} by the metal M.

B. If $E^{\circ}\left(M^{n+}/m\right)$ is positive, M^{n+} will be reduced to M by H_2

C. In a cell M^{n+}/M electrode is attached to hydrogen-half cell. To produce spontaneous cell reaction, metal M generally acts as negative electrode.

D. Compounds of active metals (Zn, Na, Mg) are reducible by H_2 whereas those of noble metals (Cu, Ag, Au) are not reducible.

Answer: D

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33. Adding powdered Pb and Fe to a solution containing 1.0 M each of Pb^{2+} and Fe^{2+} ions would result into the formation of:

A. more of Pb and Fe^{2+} ions

B. more of Fe and Pb^{2+} ions.

C. more of Fe and Pb

D. more of Fe^{2+} and Pb^{2+} ions.

Answer: A

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34. Based on the data given below, the correcy order of reducing power is:

$Fe^{3+}_{(aq.)} + e \rightarrow Fe^{2+}_{(aq.)}, E^{\circ} = +0.77V$

$Al^{3+}_{(aq.)} + 3e \rightarrow Al_{(s)}, E^{\circ} = -1.66V$

$Br_{2(aq.)} + 2e \rightarrow 2Br^{-}_{(aq.)}, E^{\circ} = +1.08V$

A. $Br^{-} < Fe(2+) < Al$

B. $Fe^{2+} < Al < Br^{-}$

C. $Al < Br^{-} < Fe^{2+}$

D. $Al < Fe^{2+} < Br^{-}$

Answer: A

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35. Which of the following has been universally accepted as a reference electrode at all temperature and has been assigned a value of zero volt?

A. Platinum electrode

B. Copper electrode

C. Graphite elctrode

D. Standard hydrogen electrode

Answer: D

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36. The temperature defining the standard electrode potential is:

A. 298 K

B. 273 K

C. 373 K

D. any temperature can be selected but it must remain constant and species must be in their standard states.

Answer: D

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37. The standard reduction potentials at 298K, for the following half cells are given:

$Zn^{2+}(aq) + 2e^{-} \Leftrightarrow Zn(s) : E^{\circ} = -0.762V$

$Cr^{3+}(aq) + 3e^{-} \Leftrightarrow Cr(s) : E^{\circ} = -0.740V$

$2H^{+}(aq) + 2e^{-} \Leftrightarrow H_2(g), E^{\circ} = 0.000V$

$Fe^{3+}(aq) + e^{-} \Leftrightarrow Fe^{2+}(aq), E^{\circ} = 0.770V$

Which is the stronget reducing agent?

A. Zn

B. Cr

C. $H_2(g)$

D. $Fe^{3+}(aq)$

Answer: A

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38. An electrochemical cell constructed for the reaction :

$Cu^{2+}(aq) + M(s) \rightarrow Cu(s) + M^{2+}(aq)$

has an $E^{\circ} = 0.75V$. The standard reduction potential for $Cu^{2+}(aq)$ is 0.34V. What is the standard reduction potential for M^{2+} (aq)?

A. 1.09V

B. $1.09V$

C. $0.410V$

D. $-0.410V$

Answer: C

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39. A solution containing one mole per litre of each $Cu(NO_3)_2, AgNO_3, Hg_2(NO_3)_2$ is being electrolysed by using inert electrodes. The values of standard electrode potentials in volts (reduction potentials) are

$Ag^+/Ag = +0.80V, HG_2^{2+}/Hg = +0.79V$

$Cu^+/Cu = +0.34V, Mg^{2+}/Mg = -2.37V$

With increasing valtage, the sequence of deposition of metals on the cathode will be

A. Ag, Cu, Hg, Mg

B. Ag, Hg, Cu, Mg

C. Ag, Hg, Cu

D. Cu, Hg, Ag

Answer: C

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40. The standard reduction potential E° of the following systems are:-

$System$	E° (volts)
$(i) MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$	1.51
$(ii) Sn^{4+} + 2e^- \rightarrow Sn^{2+} 0.15$	
$(iii) Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$	1.33
$(iv) Ce^{4+} + e^- \rightarrow Ce^{3+} 1.61$	

The oxidising power of teh various species decreases in the order

A. $Ce^{4+} > Cr_2O^{2-7} > Sn^{4+} > MnO^{-4}$

B. $Ce^{4+} > MnO^{-4} > Cr_2O^{2-7} > Sn^{4+}$

C. $Cr_2O^{2-7} > Sn^{4+} > Ce^{4+} > MnO^{-4}$

D. $MnO^{-4} > Ce^{4+} > Sn^{4+} > Cr_2O^{2-7}$

Answer: B

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41. The standard oxidation potential, E°, for the reactions are given as:

$Zn \rightarrow Zn^{2+} + 2e^{-}, E^{\circ} = +0.76V$

$Fe \rightarrow Fe^{2+} + 2e^{-}, E^{\circ} = +0.41V$

The emf for the cell : $Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$

A. $-0.35V$

B. $+0.35V$

C. $+1.17V$

D. $-1.17V$

Answer: B

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42. Hydrogen gas will not reduce:

A. heated cupric oxide

B. Heated stannic oxide

C. heated stannic oxide

D. heated aluminium oxide

$$E^{\circ}_{Sn^{+4}/Sn^{+2}} = +0.15V$$

$$E^{\circ}_{Cu^{+2}/Cu^{+2}} = +0.167V$$

$$E^{\circ}_{Fe^{+3}/Fe^{+2}} = +0.771V$$

$$E^{\circ}_{Al^{+3}/Al} = -1.67V$$

Answer: D

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43. Four colourless salt solutions are placed in separation test tubes and a strip of copper is dipped in each. Which solution finally turns blue? (use data from electrochemical series

A. $Pb(NO_3 \_ (2)$

B. $AgNO_3$

C. $Zn(NO_3 \_ (2)$

D. $Cd(NO_3 \_ (2)$

Answer: B

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44. Given $E^{\circ}_{Ag^+ / Ag} = +0.8V$, $E^{\circ}_{Ni^{+2} / Ni} = -0.25V$. Which of the folowing statements is true?

A. Ag^+ is an oxidizing agent but Ni^{+2} is a reducing agent.

B. Ni^{+2} can be reduced by silver metal

C. Ag^+ is a better oxidizing agent than Ni^{2+} and Ni is a better reducing agent than Ag.

D. Ni^{+2} is a better oxidizing agent than Ag^{+} and Ag is a better reducing agent than Ni.

Answer: C

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45. Using the standard potential values given below, decide which of the statements P,Q,R,S are correct?

Choose the right answer from (a), (b), (c) and (d).

$Fe^{2+} + 2e^{-} \rightarrow Fe, E^{\circ} = -0.44V$

$Cu^{2+} + 2e^{-} \rightarrow Cu, E^{\circ} = +0.34V$

$Ag^{+} + e^{-} \rightarrow Ag, E^{\circ} = +0.80V$

(P) Copper can displace iron from $FeSO_4$ solution

(Q) Iron can displace copper from $CuSO_4$ solution

(S) Iron can displace silver from $AgNO_3$ solution

A. P and Q

B. Q and R

C. Q and S

D. P and S

Answer: C

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46. $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)\ E^{\circ} = 0.80V$

$Co^{2+}(aq) + 2e(-) \rightarrow Co(s)\ E^{\circ} = -0.28V$

Use the standard reduction potentials to determine the standard potential for the reaction:

$Co(s) + 2Ag^{+}(aq_{\square}) \rightarrow Co^{2+}(aq) + 2Ag(s)$

A. 0.52V

B. 0.66V

C. 1.08V

D. 1.88V

Answer: C

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47. E° of $Mg^{2+}||Mg$, $Zn^{2+}||Zn$, and $Fe^{2+}| \, |Fe$ are -2.37V, -0.76V and -0.44 V respectively. Which of the following is correct?

A. Mg oxidizes Fe

B. Zn oxidizes Fe

C. Zn reduces Mg^{2+}

D. Zn reduces Fe^{2+}

Answer: D

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48. A standard hydrogen electrode has zero electrode potential because :

A. hydrogen is easier to oxidise.

B.

C. this electrode potential is assumed to be zero

D. hydrogen atom is only one electron

Answer: B

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49. Which of the following metals could be used successfully to galvanize iron?

[Given:

$E^{\circ}_{Ni^{+2}/Ni} = -0.23V$ E_(Cu^(+2)//Cu)^(@) = -0.34VE_(Sn^(+2)//Sn)^(@) = -0.14VE_(Mn^(+2)//Mn)^(@) = -1.18VE_(Fe^(+2)//Fe)^(@) = -0.41V`

A. Ni

B. Cu

C. Sn

D. Mn

Answer: D

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50. Which cell will measure standard electrode potential of copper electrode?

A. $Pt(s)||H_2(g, 0.1\text{bar})||H^+(aq., 1M)\Big|\Big|Cu^{2+}(aq., 1M)\Big|\Big|Cu$

B. $Pt(s)||H_2(g, 1\text{bar})||H^+(aq., 1M)\Big|\Big|Cu^{2+}(aq., 2M)\Big|\Big|Cu$

C. $Pt(s)||H_2(g, 1\text{bar})||H^+(aq., 1M)\Big|\Big|Cu^{2+}(aq., 1M)\Big|\Big|Cu$

D. $Pt(s)||H_2(g, 0.1\text{bar})||H^+(aq., 1M)\Big|\Big|Cu^{2+}(aq., 1M)\Big|\Big|Cu$

Answer: C

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51. Potential for some half cell reactions are given below. On the basis of these mark the correct answer.

(i) $H^+(aq) + e^- \rightarrow \left(\frac{1}{2}\right)H^2(g)\ E^\circ_{cell} = 0.00V$

(ii) $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-, E_{cell} = 1.96V$

(iii) $2SO_4^{2-}(aq) \rightarrow S_2O_8^{2-}(aq) + 2e^-, E^\circ_{cell} = 1.96V$

A. In dilute sulphuric acid solution, hydrogen will be reduced at cathode.

B. In concentrated sulphuric acid solution, water will be oxidised at anode.

C. In dilute sulphuric acid solution, water will be oxidised at anode.

D. In dilute sulphuric acid solution, SO_4^{2-} ion will be oxidised to tetrathionate ion at anode.

Answer: C

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52. $Al^{3+}(aq) + 3e^- \rightarrow Al(s)\ E^\circ = -1.66V$

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)\ E^\circ = +0.34V$

What voltage is produced under standard conditions by combining the half-reactions witih these standard Electrode Potential?

A. 1.32V

B. 2.00V

C. 2.30V

D. 4.34V

Answer: B

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53. Use the information in the table and calcualate E° for this reaction.

$Ga(s) + 3Tl^{+}(aq) \rightarrow 3Tl(s) + Ga^{3+}(aq)$

Reaction	E°
$Ga^{3+}(aq) + 3e^{-} \rightarrow Ga(s)$	$-0.529V$
$Tl^{+}(aq) + e^{-} \rightarrow Tl(s)$	$-0.336V$

A. 0.479V

B. 0.193V

C. $-0.193V$

D. $0.479V$

Answer: B

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54. Nickel metal is added to a solution containign 1.0 m $Pb^{2+}(aq)$ and $1.0M$Cd^(2+)(aq)

$. Usethes\tan dardreductionpotentials \rightarrow \det er \min ewhichreaction(s)u$

Ni(s) + Pb^(2+)(aq) rightarrow Pb(s) + Ni^(2+)(aq)$Reaction2:$ Ni(s) + Cd^(2+)(aq) rightarrow Cd(s) + Ni^(2+)(aq){:("Reaction", E^(@)), (Pb^(2+)(aq) + e^(-) rightarrow Pb(s) , -0.13V), (Ni^(2+)(aq) + 2e^(-) rightarrow Ni(s), -0.23V), (Cd^(2+)(aq) + 2e^(-) rightarrow Cd(s), -0.40V):}`

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: A

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55. Which of the half reactions, when coupled, will make a galvanic cell that will produce the largest voltage under standard conditons?

P. $Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)\ E^{\circ} = +0.34V$

Q. $Pb^{2+}(aq) + 2e^{-} \rightarrow Pb(s)\ E^{\circ} = -0.13V$

R. $Ag^{+}(aq) + 3e^{-} \rightarrow Al(s)\ E^{\circ} = -1.66V$

A. P and Q

B. P and S

C. Q and S

D. R and S

Answer: D

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56. Cu metal displaces $Ag^{+}(aq)$ from its aqueous solution. Which of the following is correct?

A. Cu^{2+} is better oxidising agent than Ag^{+}

B. Ag is a better reducing agent than Cu

C. Ag is easier to oxidise than Cu

D. Ag^{+} is easier to reduce than Cu^{2+}.

Answer: D

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57. $Au^{3+}+3^{-} \rightarrow Au(s)\ E^{\circ}=1.50V$

$Cu^{2+}+2e^{-} \rightarrow Cu(s)\ E^{\circ}=0.34V$

According to the standard reduction potentials above, a substance that can oxidize only one of these metals must have an E° value:

A. less than 0.34V

B. between 0.34 and 0.80 V

C. between 0.80 and 1.50V

D. greater than 1.50V

Answer: B

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58. Use the standard reduction potentials to determine what is observed at the cathode during the electrolysis of a 1.0 M solution of KBr that contains phenolphthalein.

$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)\ E^\circ = 1.23V$

$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)\ E^\circ = 1.07V$

$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-\ E^{\circ 0 = -0.80V}$

$K^+(aq) + e^- \rightarrow K(s)\ E^\circ = -2.92V$

A. Solid metal forms.

B. Bubbles form and a pink colour appears.

C. Dark red $Br^2(aq)$ forms.

D. Dark red $Br_2(aq)$ forms.

Answer: B

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59. Three metals, A, B and C, with solutions of their respective cations are tested in a voltaic cell with the following results:

A and B: A is the cathode

B and C: C is the cathode

A and C : A is the anode

What is the order of reduction potentials from highest to lowest for the cations of these metals?

A. A gt B gtC

B. B gt C gtA

C. C gt A gt B

D. B gt A gtC

Answer: C

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60. According to the reductions potentials in the table below, which statements is true under standard conditions?

Reaction	$E^{\circ} V$
$L^{2+} + 2e^{-} \rightarrow L$	-0.13
$M^{2+} + 2e^{-} \rightarrow M$	-0.44
$N^{2+} + 2e^{-} \rightarrow N$	-0.76

A. L^{2+} ions oxidize M metal

B. M metal reduces $\left(N^{2+}\right.$ ions.

C. M is a better reducing agent than N

D. M^{2+} ions are better oxidizing agents than L^{2+} ions.

Answer: A

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61. $Sn^{4+}(aq) + 2e^- \to Sn^{2+}(aq)\ E^\circ = 0.15V$

$Cr^{3+}(aq) + e^- \to Cr^{2+}(aq)\ E^\circ = 0.41V$

According to the standard reduction potentials above, what is the value of E° for the reaction below?

$2Cr^{3+}(aq) + Sn^{2+}(aq) \to 2Cr^{2+}(aq) + Sn^{4+}(aq)$

A. $-0.97V$

B. $-0.56V$

C. $+0.56V$

D. $+0.97V$

Answer: B

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62. Which two substances react spontaneously?

A. Ag and Cu

B. Ag^{+} and Cu

C. Ag and Cu^{2+}

D. Ag^{+} and Cu^{2+}

Answer: B

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63. An unknown mtal, M, and its salt, $M(NO_3 _ (2)$are combined with a half-cell in which the following reaction occurs: $2Ag^{+} + M \rightarrow 2Ag + M^{2+}$

$Ag^{+}(aq) + e(-) \rightarrow Ag(s)$ $\left[E^{\circ}_{red} = 0.80V\right] I f$E_(cell)^(@) $= 1.36V, w\hat{i} s$E_(red)^(@)f or M^(2+)(aq) + 2e^(-) rightarrow M(s)`?

A. 0.56V

B. 0.24V

C. $-0.24V$

D. $-0.56V$

Answer: D

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64. According to the standard reduction potentials:

$Pb^{2+}(aq)+2e^{-} \rightarrow Pb(s)\ E^{\circ}=-0.13V$

$Fe^{2+}(aq)+2e^{-} \rightarrow Fe(s)\ E^{\circ}=-0.44$

$Zn^{2+}(aq)+2e^{-} \rightarrow Zn(s)\ E^{\circ}=-0.76V$

Which species will reduce Mn^{3+} to $Mn^{2+}[E^{\circ}=1.51V$ but will NOT reduce $Cr^{3+} \rightarrow Cr^{2+}[E^{\circ}=-0.40V]$

A. Pb only

B. Zn only

C. Pb and Fe only

D. Pb, Fe, and Zn

Answer: A

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65. Which expression gives the correct value of the standard potential for a gold-rhodium voltaic cell?

Half-reaction	$E^\circ V$
$Rh^{3+}(aq) +_3 e^- \rightarrow Rh(s)$	0.76
$Au^+(aq) + e^- \rightarrow Au(s)$	1.69

A. $1.69 + 0.76$

B. $1.69 = 0.76$

C. $3(1.69) + 0.76$

D. $3(1.69) - 0.76$

Answer: B

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66. Consider the following reactions:

$X\left(NO_3 \_ (2) + Y \rightarrow X + Y(NO_3)_2\right.$

$X(NO_{3} \_ (2) + Z \rightarrow X + Z(NO_{3} \_ (2)$

$Y(NO_{3} \_ (2) + Z \rightarrow \text{No reaction}$

What is the correct order of increasing activity for the metals, X,Y,Z?

A. X lt Y lt Z

B. X lt Z lt Y

C. Z lt Y lt X

D. Z lt X lt Y

Answer: B

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67. When connected to a Standard Hydrogen Electrode (SHE) electrons flow from an unknown half cell to the SHE. Which statement is correct?

A. The unknown half cell is the anode.

B. Oxidation occurs at the SHE.

C. E°_{red} for the unknown half cell is positive.

D. E°_{cell} is negative.

Answer: A

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68. Given these standards reduction potentials, what is the free energy change (in kJ. Mol^(-) for the reaction:

$Pb(s)+2Ag^{+}(aq)\rightarrow Pb^{2+}(aq)+2Ag(s)$

$Ag^{+}(aq)+e^{-}\rightarrow Ag(s)\ E^{\circ}=0.80V$

$Pb^{2+}(aq)+2e^{-}\rightarrow Pb(s)\ E^{\circ}=-0.13V$

A. -180

B. -90

C. 90

D. 180

Answer: A

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69. Given the standard reduction potentials, which statement is correct?

$$Cu^2(aq) + 2e^- \rightarrow Cu(s) \quad E^\circ = 0.34V$$
$$2H^+(aq) + 2e^- \rightarrow H_2(g) \quad E^\circ = 0.0V$$
$$Cr^{3+}(aq) + 2e^- \rightarrow Cr(s) \quad E^\circ = -0.73V$$

A. Cr(s) will react with acid.

B. Cu(s) will react with acid.

C. $Cu^{2+}(aq)$ will react with acid

D. Cu(s) will reacct with $Cr^{3+}(aq)$

Answer: A

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70. In a galvanic cell in which the following spontaneous reaction takes place, what process occurs at the cathode?

$3Ce^{4+}(aq) + Cr(s) \rightarrow 3Ce^{3+}(aq) + Cr^{3+}(aq)$

A. Reduction of $Cr^{3+}(aq)$

B. $Reductio \in of$Ce^(4+)(aq)`

C. Oxidation of Cr(s)

D. Cu(s) will react with $Cr^{3+}(aq)$

Answer: B

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71. For a galvanic cell involving the half-reaction at standard conditions,

$Au^{3+} + 3e(-) \rightarrow Au \; E^{\circ} = 1.50V$

$Tl^{+} + e(-) \rightarrow Tl \; E^{\circ} = -0.34V$

A. 0.48V

B. 1.16V

C. 1.84V

D. 2.52V

Answer: C

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72. According to the half-reaction table,

$Sn^{2+} + 2e^{-} \rightarrow Sn\ E_{\circ} = -0.14V$

$Mn^{2+} + 2e^{-} \rightarrow Mn\ E^{\circ} = -1.03V$

Which species in the better oxidizing agent?

A. Mn^{2+}

B. Sn^{2+}

C. Mn

D. Sn

Answer: B

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73. The reduction potentials for the +2 cations, e.g.

$A^{2+} + 2e^{-} \rightarrow A,$

of four metals decrease in the order A, B,C,D, which Statements is/are true?

(P) A reduces B^{2+} oxidizes C

(Q) B^{2+} oxidizes C

(R) B oxides D

A. Q only

B. R only

C. P and Q only

D. P and R only

Answer: A

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74. $E^{\circ} = 0.93V$ for the reactions:

$Fe(s) + 2M^{+}(aq) \rightarrow Fe^{2+}(aq) + 2M(s)$

What is the standard potential for $M^{+} + e^{-} \rightarrow M$, if $E_{Fe^{2+}/Fe^{\wedge}}(\circ) = -0.44V$?

A. 0.26V

B. 0.49V

C. 0.67V

D. 1.34V

Answer: B

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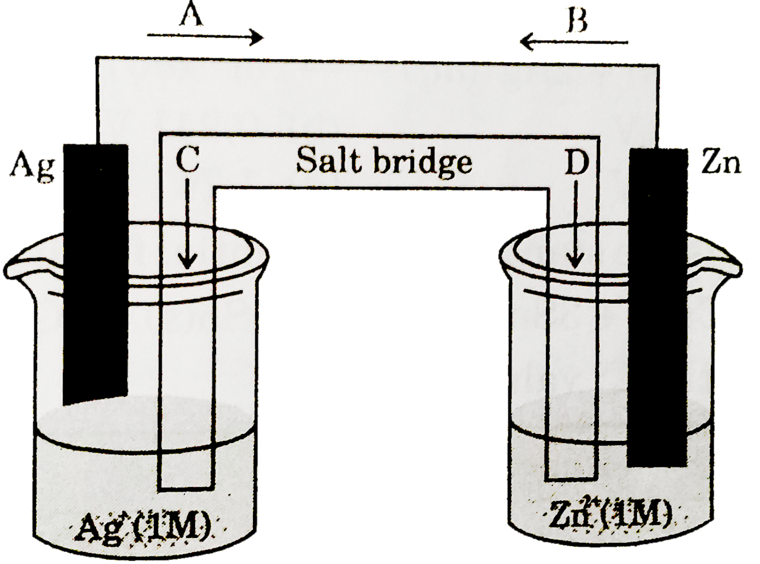
75. In the galvanic cell shown below, which arrow indicates the spontaneous electron flow?



A. A

B. B

C. C

D. D

Answer: B

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76. What is the standard cell potential for the voltaic cell?

$Cr||Cr^{3+}||Pb^{2+}\ |\ |\ Pb$

Reaction	E°_{red}/V
$Pb^{2+} + 2e^{-} \rightarrow Pb$	-0.13
$Cr^{3+} + 3e^{-} rightarrowCr$	-0.74

A. 1.09V

B. 0.61V

C. $-0.61V$

D. $-1.09V$

Answer: B

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77. What is the E° value for the voltaic cell constructed from the half-cells?

Reaction	$E^{\circ}(V)$
$Zn^{2+} + 2e^{-} \rightarrow Zn$	-0.762
$Tl^{+} + 3e^{-} \rightarrow Tl$	-0.036

A. 0.090V

B. 0.426v

C. 1.098v

D. $-0.036V$

Answer: B

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78. Based on the reactions and data below, which reaction is least spontaneous?

Reduction	E° (V)
$2Hg^{2+} + 2e^- \longrightarrow Hg_2^{2+}$	1.82
$I_2 + 2e^- \longrightarrow 2I^-$	0.53
$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$	–0.83

A. $2H^{2+} + 2e^- \rightarrow Hg^{2+_2} + I_2$

B. $H_2 + 2OH^- + I_2 \rightarrow 2H_2O + 2I^-$

C. $2H_2O + Hg_2^{2+} \rightarrow H_2 + 2OH^- + 2Hg^{2+}$

D. $H_2 + 2OH^- + 2Hg^{2+} \rightarrow 2H_2O + Hg_2^{2+}$

Answer: C

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79. Use the standard reduction potentials:

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)\ E^\circ = -0.141V$

$Ag^+(aq) + e^- \rightarrow Ag(s)\ E^\circ = 0.800V$

To calcultate E° for the reaction:

$Sn(s) + 2Ag^+(aq) \rightarrow Sn^{2+}(aq) + 2Ag(s)$

A. 0.659V

B. 0.941V

C. 1.459V

D. $1.741V$

Answer: B

80. What is the standard cell potential for the reaction,

$2Cr(s) + 3Sn^{2+}(aq) \rightarrow 3Sn(s) + 2Cr^{3+}(aq)$

given the E° values shown?

Reaction	E°
$Cr^{3+}(aq) + 3e^{-} \longrightarrow Cr(s)$	-0.744 V
$Sn^{2+}(aq) + 2e^{-} \longrightarrow Sn(s)$	-0.141 V

A. 0.945V

B. 0.603V

C. $-0.603V$

D. $-0.945V$

Answer: B

81. Which is the weakest oxidizing agent in a 1 M aqueous solution?

A. $Ag^{+}(aq)$

B. $Cu^{2+}(aq)$

C. $H^{+}(aq)$

D. $Zn^{2+}(aq)$

Answer: D

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82. Consider the cell potentials $E^0_{Mg^{2+}|Mg} = -2.37V$ and $E^0_{Fe^{3+}|Fe} = -0.04V$

The best reducing agent would be

A. Mg^{2+}

B. Fe^{3+}

C. Mg

D. Fe

Answer: C

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83.

Half-Reaction	E° (V)
$Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$	-0.76
$Cr^{3+}(aq) + 3e^- \longrightarrow Cr(s)$	-0.744
$Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$	-0.409

Use the E° values in the table above to the determining which of the following reactions will give the highest potential in a voltaic cell?

A. $3Zn^{2+}(aq) + 2Cr(s) \rightarrow 3Zn(s) + 2Cr^{3+}(aq)$

B. $3Zn(s) + 2Cr^{3+}(aq) \rightarrow 3Zn^{2+}(aq) + 2Cr(s)$

C. $Zn^{2+}(aq) + Fe(s) \rightarrow Zn(s) + Fe^{2+}(aq)$

D. $Zn(s) + Fe^{2+}(s) \rightarrow Zn^{2+}(aq) + Fe(s)$

Answer: D

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84.

Half-Reaction	$E°(V)$
$2H^+ + 2e^- \longrightarrow H_2$	0.00
$Pd^{2+} + 2e^- \longrightarrow Pd$	0.90
$O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$	1.23

According to the equations and data in the table above, which species is the strongest reducing agent of the following choices?

A. H^+

B. H_2

C. H_2O

D. Pd^{2+}

Answer: B

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85.

Half-Reaction	$E°(V)$
$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$	0.340
$Sn^{2+}(aq) + 2e^- \longrightarrow Sn(s)$	–0.136
$Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$	–0.440
$Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$	–0.763
$Mg^{2+}(aq) + 2e^- \longrightarrow Mg(s)$	–2.37

According to the standard reduction potentials above, cathodic protection of iron can be achieved by:

A. Cu(s) only

B. Cu(s) and Sn(s) only

C. Mg(s) only

D. Mg(s)_ and Zn(s) only

Answer: D

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Electrochemical Series and its Applications

1. E° for $F_2 + 2e^- \Leftrightarrow 2F^-$ is $2.8V$, E° for $\frac{1}{2}F + e^- = F^-$ is $-$

A. 2.8V

B. 1.4V

C. $-2.8V$

D. $-1.4V$

Answer: A

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Latimer Diagram, concentration cells

1. Given $E^{\circ}_{Cr^{3+}/Cr} = -0.72V$, and

$E^{\circ}_{Fe^{2+}/Fe} = -0.42V$

The potential for the cell.

$Cr\left|Cr^{3+}(0.1M)\right|\,|\,Fe^{2+}(0.01M)Fe$ is

A. 0.339V

B. $0.339V$

C. $-0.26V$

D. 0.26V

Answer: D

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2. Which set of relationships could apply to the same electrochemical cell?

A. $\Delta G^{\circ} > 0, E^{\circ} = 0$

B. $\Delta G^{\circ} < 0, E^{\circ} = 0$

C. $\Delta G^{\circ} > 0, E^{\circ} > 0$

D. $\Delta G^{\circ} < 0, E^{\circ} > 0$

Answer: D

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3. For a spontaneous reaction, $\Delta G,$ equilibrium constant (K) and E°_{cell} will be respectively:

A. $-ve, \ > 1, \ +ve$

B. $+ve, \ > 1, \ -ve$

C. $-ve, \ < 1, \ -ve$

D. $-ve, \ > 1, \ -ve$

Answer: A

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4. What is the value fo $\Delta G^{\circ 0}$ for the reactions?

$2Al(s) + 3Cu^{2+}(aq) \rightarrow \ + 3Cu(s)E^{\circ} \ = 2.02V$

A. $1170kJ$

B. $-585kJ$

C. $-390kJ$

D. $-195kJ$

Answer: A

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5. Which of the following statement is correct?

A. E_{cell} and ΔG of cell reaction both are extensive properties.

B. E_{cell} and $\Delta(G)$ of cell reaction both are intensive properties.

C. $E_{cell} isan \int ensivepeopertywhi \leq$ Delta(G)` of cell reaction is an extensive property.

D. E_{cell} is an extensive property while ΔG of cell reactioin is an intensive property.

Answer: C

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6. The equilibrium Cu^{++} (aq) + Cu(s) rightarrow 2Cu^(+)$establishedat$ 20^(@)Cc or $responds \to$ [Cu^(++)]/[Cu^(+)]^(2) = 2.02 x x10^(4) $. The s \tan dard potential,$ E_(Cu^(++)//Cu)^(@) = 0.33 $vo < . At this temperature, w\hat{i} s the s \tan dard potential,$ E_(Cu//Cu)^(@)`?

A. $-0.457V$

B. $1.54V$

C. $1.26V$

D. `0.42V

Answer: A

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7. Given these standard reduction potentials, what is the standard reduction potential for

$Co^{3+}(aq) + 3e^{-} \rightarrow Co(s)$?

$Co^{3+}(aq) + e^{-} \rightarrow Co^{2+}(aq) E^{\circ} = 1.82V$

$Co^{2+}(aq) + 2e^{-} \rightarrow Co(s) E^{\circ} = -0.28V$

A. 2.10V

B. 1.54v

C. 1.26v

D. 0.42V

Answer: D

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8. The equilibrium constant, K, is 2.0×10^{19} for the cell

$Ni(s) || Ni^{2+}(aq) || Hg_2^{2+}(aq) \mid Hg(l)$

The value of E° at 25°C for this cell is closest to:

A. $-1.14V$

B. $-0.57V$

C. $0.57V$

D. $1.14V$

Answer: C

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9. Given that $E^{\cdot}_{Fe^{2+}/Fe} = -0.44V, E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.77V$ if Fe^{2+}, Fe^{3+} and Fe solid are kept together then

A. Fe^{3+} increases

B. Fe^{3+} decreases

C.

D. Fe^{2+}/Fe^{3+} remains unchanged

Answer: A

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10. Given, $E^o_{Fe^{3+}/Fe} + 3eCrE^o = -0.036V$
$E^o_{Fe^{3+}/Fe} = -0.439V$

The value of standard electrode ptoential for the charge,

A. $0.385V$

B. $0.770V$

C. $-0.270V$

D. $-0.072V$

Answer: B

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11. The electrode potential becomes equal to standard electrode potential when reactants and products concentration ratio is:

A. Equal to 1

B. greater than 1

C. less than 1

D. none of these

Answer: A

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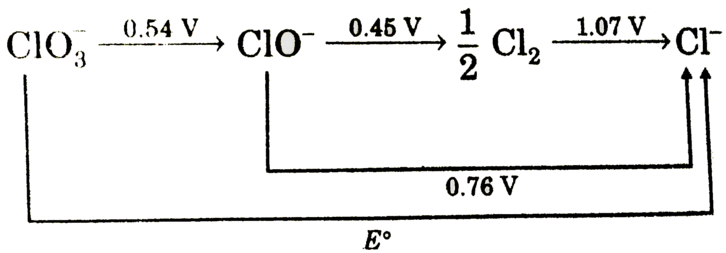
12. 

The E° in the given figure is:

A. 0.5

B. 0.6

C. 0.7

D. 0.8

Answer: B

View Text Solution

13. Based on the data given for half cell

$\left(M^{x+n}+, M^{x+} \mid \mid Pt\right.$

% of reduced form 50 20

Potential (V) 0.1, 0.112

the value of n is:

A. 2

B. 3

C. 4

D. 5

Answer: B

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14. A silver wire dipped in $0.1 MHCI$ solution saturated with $AgCI$ develops a potential of $-0.25V$. If $E^{\circ}_{Ag/Ag^{+}} = -0.799V$, the K_{sp} of $AgCI$ in pure water will be

A. 2.95×10^{-11}

B. $5.0x10^{-11}$

C. 3.95×10^{-11}

D. 1.95×10^{-11}

Answer: B

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15. $2Ce^{4+} + Co \rightarrow 2Ce^{3+} + Co^{2+}, E^{\circ}_{cell} = 1.89V$

$E^{\circ}_{Co^{2+}/Co} = -0.277V$. Hence $E^{\circ}_{Ce^{4+}/Ce^{3+}}$ is

A. 0.805V

B. 1.613V

C. $-0.805V$

D. $-1.613V$

Answer: B

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16. $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O, E^\circ = 1.51V$

$MnO_2 + 4H^+ + 2e^- rig \leftrightarrow owMn^{2+} + 2H_2O\ E^\circ = 1.23V$

$E_{MnO_4^- | MnO_2}$

A. 1.70V

B. 0.91V

C. 1.37v

D. 0.548V

Answer: A

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17. Find EMF of cell $Pt|H_2|H^+(pH = 5)||H^+(pH = 7)|H_2|Pt.$

Given that $\dfrac{2.303RT}{F} = 0.06$

A. 6 volt

B. -0.06 volt

C. -0.12 volt

D. 0 volt

Answer: C

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18. For the cell $Pt|H_2|HCl\ |\ \ |\ Ag^+|Ag,$

E_{cell} can be increased by:

A. decreasing pressure of H_2 gas

B. diluting the solution in cathodic half cell

C. decreasing the pH in anodic half cell

D. diluting the solutioni in anodic half cell

Answer: D

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19. Calculate the cell potential E at 25° C for the reactioni :

$2Al(s) + 3Fe^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Fe(s)$

[Given : $\left[Fe^{2+}\right] = 0.01M, \left[Al^{3+}\right] = 0.10M,$

$E^{-}\left(Fe^{+2} / Fe\right)^{\circ} = -0.45V$ and $\left(\frac{2.303Rt}{F} = 0.06\right)$

A. $+1.20V$

B. $+1.16V$

C. $+1.24V$

D. $+1.12V$

Answer: B

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20. $Cu^{+} + e^{-} \rightarrow Cu, E^{\circ} = x1vo <$,

$Cu^{2+} + 2e^{-} \rightarrow Cu, E^{\circ} = x_2$ volt, then for

$Cu^{2+} + e^{-} \rightarrow Cu^{+}, E^{\circ}$ (volt) will be :

A. $x_1 - 2x_2$

B. $x_1 + 2x_2$

C. $x_1 - x_2$

D. $2x_2 - x_1$

Answer: D

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21. KCl can be used in salt bridge as electrolyte in which of the following cells?

A. $Zn|ZnCl_2||AgNO_3| \mid Ag$

B. $Pb|Pb(NO_3)_2||Cu(NO_3)_2| \mid Cu$

C. $Cu|CuSO_4||AuCl_3|Au$

D. `Fe | FeSO_(4) || Pb(NO_(3))_(2)| Pb

Answer: C

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22. The reaction

$1/2H2(g) + AgCl(s) \rightarrow H^{\oplus}(aq) + Cl^{c-}(aq) + Ag(s)$ occurs in the galvanic cell.

A. $Ag/AgCl(s)|KCl(sol)||AgNO_3(sol)|Ag$

B. $Pt/H_2(g)|HCl(sol)||AgNO_3(sol)|Ag$

C. $Pt/H_2(g)|HCl(sol)||Cl^-|AgCl(sol) \mid Ag$

D. $Pt/H_2(g)|KCl(sol)||AgCl(sol)|Ag$

Answer: C

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23. Which statements is true about a spontaneous cell reaction in galvanic cell?

A. $E^{\circ}_{cell} > 0, \Delta G^{\circ} < 0$ and $Q < K$

B. $E^{\circ}_{cell} > 0, \Delta G^{\circ} < 0$ and $Q > K$

C. $E^{\circ}_{cell} > 0, \Delta G^{\circ} > 0$ and $Q > K$

D. $E^{\circ}_{cell} > 0, \Delta G^{\circ} < 0$ and $Q < K$

Answer: D

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24. The standard emf of the cell, $Ni|Ni^{2+}(1.0M)||Ag^{+}(1.0M)|Ag[E^{\circ}$ for $Ni^{2+}/Ni = -0.25$ volt, E° for $Ag^{+}/Ag = 0.80$ volt]

A. $-0.25 + 0.80 = 0.55vo <$

B. $-0.25 - (+0.80) = 0.55vo <$

C. $0 + 0.80 - \; -(0.25) = \; +1.05vo <$

D. $-0.80 - (-0.25) = \; -0.55vo <$

Answer: C

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25. The standard emf for the cell cell reaction $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ is 1.10 volt at $25^{\circ} C$. The emf for the cell reaction when $0.1 MCu^{2+}$ and $0.1 MZN^{2+}$ solutions are used at $25^{\circ} = C$ is .

A. 1.10Volt

B. 0.110 volt

C. $-1.10vo <$

D. $-0.110vo <$

Answer: A

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26. $Zn \mid Zn^{2+}(C_1 \mid \mid Zn^{2+}(C_2 \mid Zn$. For this cell ΔG is negative if:

A. $C_1 = C_2$

B. $C_1 > C_2$

C. $C_2 > C_1$

D. none of these

Answer: C

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27. $\left|\underset{(p_1)}{H_2}\right|\underset{(p_1)}{H^+}\left|\underset{(1M)}{H^+}\right|\underset{(p_2)}{H_2}\Big|$ Pt (where p_1 and p_(2)`are pressures) cell reactioin will be spontaneous if:

A. $p_1 = p_2$

B. $p_1 < p_2$

C. $p_2 > p_1$

D. $p_1 = 1atm$

Answer: B

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28. The reduction potential of hydrogen half cell will be negative if :

A. $p(H_2) = 1atm \text{ and } [H^+] = 2.0M$

B. $p(H_2)$ = 1 atm and $[H^+]$ = 1.0 M

C. $p(H_2$ = 2 atm and [H^(+)] = 1.0 M

D. $p(H_2$ = 2atm and $[H^+]$ = 2.0M

Answer: C

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29. $Pt|H_2|pH = 1 \mid |pH = 2|(H_2)Pt$

1 atm 1 atm

The cell reaction for the given cell is:

A. spontaneous

B. non-spontaneous

C. equilibrium

D. none of these

Answer: B

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30. In a cell that utilizes the reactions.

$Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$

addition of H_2SO_4 to cathode compartment, will

A. lower the E and shift equilibrium to the left

B. lower the E and shift the equilibrium to the right

C. increase the E and shift the equilibrium to the right

D. increase the E and shift the equilibrium to the left

Answer: C

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31. Given that (at T = 298 K)

$Cu(s)|Cu^{2+}(1.0M)||Ag^{+}(1.0M)|Ag(s)_{E^{\circ}_{cell}=0.46V}$

$Zn(s)|Zn^{2+}(1.0M)||Cu^{2+}(1.0M)|Cu(s)_{E^{\circ}_{cell}=1.10V}$

Then E_{cell} for,

$Zn|Zn^{2+}(0.1M)||Ag^{+}(1.0M)|Ag$ at 298 K will be:

A. 1.59V

B. 1.53V

C. 2.53V

D. cannot be calcualted due to insufficient data

Answer: A

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32. The cell $Pt(H_2)(1atm) \mid H^+(pH = ?)T^-(a = 1)AgI(s), Ag$ has emf, $E_{298KK} = 0.$ The electrode potaneial for the reaction $AgI + e^- \rightarrow Ag + I^{\Theta}$ is -0.151 volt. Calculate the pH value:-

A. 3.37

B. 5.03

C. 2.56

D. 4.62

Answer: C

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33. Using the information in the preceding problem, calculate the solubility product of AgI in water at $25^{\circ} C\left[E_{(Ag+Ag)}^{\circ} = +0.799vo<\right.$:-

A. $1.97x10^{-17}$

B. 7.91×10^{-17}

C. 1.79×10^{-17}

D. 9.17×10^{-17}

Answer: B

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34. The solubiltiy product of silver iodide is 8.3×10^{-17} and the standard potential (reduction) of Ag, Ag^{+} electrode is $+0.800$ volts at $25^{\circ} C$. The standard potential of $Ag, AgI/I^{-}$ electrode (reduction) from these data is

A. $-0.30V$

B. $+0.15V$

C. $+0.10V$

D. $-0.15V$

Answer: B

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35. Consider the cell $\left|\begin{matrix} H_2(Pt) \\ 1atm \end{matrix}\right|:\left|:\begin{matrix} H_3O^+(aq) \\ pH = 5.5 \end{matrix}\right|:\left|\begin{matrix} Ag^+ \\ xM \end{matrix}\right|:\left|Ag\right.$. The measured EMF of the cell is $1.023V$. What is the value of x?

$E^\circ_{Ag^+, Ag} + 0.799V$. $[T = 25^\circ C]$

A. 2×10^{-2} M

B. 2×10^{-3} M

C. 1.5×10^{-3} M

D. 1.5×10^{-2}M

Answer: A

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36. The standard potential of the reaction

$H_2O + e^- \rightarrow \left(\frac{1}{2}\right)H_2 + OH^-$ at 298 K by using $k_w(H_2O) = 10^{-14}$,

is:

A. $-0.828V$

B. $0.828V$

C. O V

D. $-0.5V$

Answer: A

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37. Given :

$Hg_2^{2+} + 2e^- \rightarrow 2Hg, \quad E^\circ = 0.789V$ and $Hg^{2+} + 2e^- \rightarrow Hg,$

$E^\circ = 0.854V$

Calculate the equilibrium consant for $Hg_2^{2+} \rightarrow Hg + Hg^{2+}$.

A. 3.13×10^{-3}

B. 3.13×10^{-4}

C. 6.26×10^{-3}

D. 6.26×10^{-4}

Answer: C

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38. The EMF of a concentration cell consisting of two zinc electrodes, one dipping into $\frac{M}{4}$ sol. Of zinc sulphate and the other into $\frac{M}{6}$ sol. Of the same salt at 25°C. is:

A. $0.0125V$

B. $0.0250V$

C. $0.0052V$

D. $0.9178V$

Answer: C

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39. The efficiency of a hypothetical cell is about 84% which involves the following reactions:

$A(s) + B^{2+}(aq) \rightarrow A^{2+}(aq)_B(s)\ \Delta H = -285kJ$

Then, the standard electrode potential of the cell will be: (Asume `DeltaS = 0)

A. 1.20 V

B. 2.40V

C. 1.10V

D. 1.24V

Answer: D

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40. The electrode potential of electrode

$M(s) \rightarrow M^{n+}(aq)(2M) + \neq^{-}$ at 298 K is E_(1). When temperature is doubled and concentration is made half, then the electrode potential becomes E_2. Which of the following represents the correct relationship between E_1 and E_2?

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 = E_2$

D. Cannot be predicted

Answer: B

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41. Two weak acid solutions HA_1 and HA_2 with the same concentration and having pK_a values 3 and 5 are placed in contact with hydrogen electrode $(1atm$ and $25^{\circ}C)$ and are interconnected through a salt bridge. Find the EMF of the cell.

A. 0.21V

B. 0.059V

C. 0.018V

D. 0.021V

Answer: B

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42. The reduction potential of a half-cell consisting of a Pt electrode immersed in $1.5MFe^{2+}$ and $0.015MFe^{3+}$ solutin at $25^{\circ}C$ is $\left(E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.770V\right)$ is .

A. 0.21 V

B. 0.88V

C. 0.710V

D. 0.850V

Answer: A

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43. what is the emf at $25^{\circ} C$ for the cell,

$$Ag \left| \begin{array}{cc} AgBr(s) & Br^{-} \\ & \alpha = 0.34 \end{array} \right\| \left| \begin{array}{cc} Fe^{3+} & Fe^{2+} \\ \alpha = 0.1 & \alpha = 0.02 \end{array} \right| Pt$$

The standard reduction potentials for the half-reactions $AgBr + e^{-} \rightarrow Ag + Br^{-}$ and $Fe^{3+} + e^{-} \rightarrow Fe^{2+}$ are +0.0713V and +0.770V respectively.

A. 0.474 volt

B. 0.529 volt

C. 0.356 volt

D. 0.713 volt

Answer: B

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44. At $25^{\circ} C$, $\begin{array}{lll} Ag + I^{-} \rightarrow & AgI + e & E^{\circ} = 0.152V \\ Ag \rightarrow & Ag.^{+} + e & E^{\circ} = -0.80V \end{array}$

The $\log K_{sp}$ of AgI is: $\left(\frac{2.303RT}{F} = 0.059\right)$

A. -8.12

B. $+8.612$

C. -37.83

D. 16.13

Answer: D

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45. The cell , $Zn|Zn^{2+}(1M)|\,|Cu^{2+}(1M)Cu\left(E^{\circ}_{\text{cell}} = 1.10V\right)$,

Was allowed to be completely discharfed at $298K$. The relative concentration of $2+$ to $Cu^{2+}\left[\frac{Zn^{2=}}{Cu^{2+}}\right]$ is :

A. $10^{37.3}$

B. 9.65×10^4

C. antilog (24.08)

D. 37.3

Answer: A

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46. $Pt(Cl_2)(p_1)|HCl(0.1M)|(Cl_2)(p_2), Pt$ cell reaction will be endergonic if

A. $P_1 = P_2$

B. $P_1 > P_2$

C. $P_2 > P_1$

D. $P_1 = P_2 = 1atm$

Answer: C

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47. $Pt\left|\begin{array}{c}(H_2)\\ 1atm\end{array}:\right|pH=2:|:|:pH=3\left|:\begin{array}{c}(H_2)Pt\\ 1atm\end{array}:\right|$. The cell reaction for the given cell is:-

A. Spontaneous

B. non-spontaneous

C. equilibrium

D. none of these

Answer: B

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48. Cosoder the reactopm: $(T=298K)$

$Cl_2(g)+2BR^-(aq)\rightarrow 2Cl^-(aq)+Br_2(aq.)$

The emf of he cell, when $[Cl^- = (Br_2] = [Br^-] = 0.01M$ and Cl_2 gas is at 1 atm pressure, will be :

(E° for the above reaction is $= 29$ volt).

A. 0.54volt

B. 0.35volt

C. 0.24volt

D. $-0.29vo <$

Answer: B

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49. The Ni / Ni^{2+} and F^- / F_2 electrodes potentials are listed as $+0.25V$ and $-2.87V$ respectively (with respect to the standard hydrogen electode). The cell potential when these are coupled under standard conditions is:

A. 2.62 V and dependent on the reference electrode chosen.

B. 3.12 V and independent on the reference electrode chosen.

C. 3.12 V and dependent on the reference electrode chosen.

D. 2.62 V and independent on the reference electrode chosen.

Answer: B

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50. Which one of the following will increase the voltage of the cell ? $(T = 298K)$

$Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag.$

A. Increase in the size of silver rod

B. increase in the concentration of Sn^{2+} ions

C. Increase in the concentration of Ag^+ ions

D. None of the above.

Answer: C

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51. Pure water is saturated with pure solid AgCl, a silver electrode is placed in the solution and the potential is measured agains normal calomet electrode at $25^\circ C$. This experiment is then repeated with a saturated solution of AgI. If the difference in potential in the two cases is 0.177V. What is the ratio of solubility product (solubility) of AgCl and AgI at the temperature of the experiment?

A. 10^3

B. 10^6

C. 10^2

D. 10^4

Answer: A

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52. A hydrogen electrode X was placed in a buffer solution of sodium acetate and acetic acid in the ratio $a : n$ and another hydrogen electode Y was placed in a buffer solution of sodium acetate and acetic acid in the ratio $b : a$. If reduction potential values for two cells are found to be E_1 and E_2 respectively w.r.t standard hydrogen electrode, the pK_a value of the acid can be given as:

A. $\frac{E_1 - E_2}{0.118}$

B. $-\left[\frac{E_1 + E_2}{0.118}\right]$

C. $\left(\left(E - \frac{1}{E} - (2)\right) \times 0.118\right.$

D. $\frac{E - (2) - E_1}{0.118}$

Answer: B

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53. Wlhich of the following cell can produce more electrical work?

A. $Pt, H_2|NH_4Cl||0.1MCH_3COOH|H_2, Pt$

B. $Pt, H_2|0.1MHCl||0.1MNaOH|H_2, Pt$

C. $Pt, H_2|0.1MCH_3COOK|H_2, Pt$

D. $Pt, H_{92})|0.1MCH_3COOK||0.1MHCl|H_2, Pt$

Answer: D

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54. A hydrogen electrode is immersed in a solution with pH = 0 (HCl). By how much will the potential (reduction) change if an equivalent amount of NaOH is added to this solution?

(Take $p_{H_2=1atm}$ T=298K

A. Increase by 0.41V

B. increase by 59 mV

C. Decrease by 0.41V

D. Decrease by 59mV

Answer: C

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55. If the pressure of hydrogen gas is increased from 1atm to 100atm, keepimng the hydrogen ion concentratioin constant at 1M, the new reduction potential of the hydrogen half cell is at $25^\circ C$ will be:

A. $0.059V$

B. $-0.059V$

C. $0.295V$

D. $0.118V$

Answer: B

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56. For the cell (at 298K)

$Ag(s)|AgCl(s)|Cl^{-}(aq)\ ||\ |AgNO_3(aq)|Ag(s)$

Which of the following is correct?

A. The cell emf will be zero when $\left[Ag^{+}\right]_a$ = $\left[Ag^{+}\right]_c$ ([Ag^(+)] in anodic compartment = $\left[Ag^{+}\right]$ in cathodic compartment).

B. The amount of AgCl(s). Precipitate in anodic compartment will decrease with the working of the cell.

C. The concentration of $\left[Ag^{+}\right]$ = constant, in anodic compartment during working of cell .

D. $E_{cell} = E^{\circ}_{Ag^{+}\,|\,Ag} - \left(\frac{0.059}{1}\right)\log\left(\frac{1}{[Cl^{-}]_a}\right)$

Answer: A

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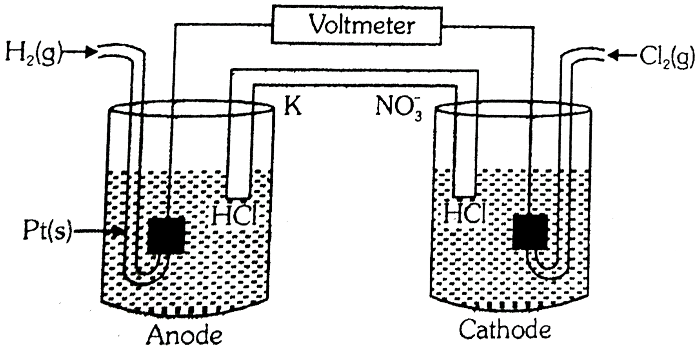
57. Consider the following Galvanic cell:-



By what value the cell voltage when concentration of ions in anodic and cathodic compartments both increased by factor of 10 at 298K:

A. $+0.591$

B. -0.0591

C. -0.1182

D. 0

Answer: C

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58. By how much will the potential of half-cell $Cu^{2+} \mid Cu$ change if the solution is diluted to 100 times at 298K?

A. Increase by 59 mV

B. Decrease by 59 mV

C. Increase by 29.5mV

D. Decrease by 29.5 mV

Answer: B

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59. The emf of the cell,

$Zn \left| Zn^{2+}(0.01M) \right| \left| Fe^{2+}(0.001M) \right| Fe$

at 298 K is 0.2905 then the value of equilibrium constant for the cell reaction is:

A. $e^{\frac{0.32}{0.0295}}$

B. $1 - \frac{0.32}{0.0295}$

C. $10^{\frac{0.26}{0.0295}}$

D. $10^{\frac{0.32}{0.0591}}$

Answer: B

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60. For a cell reaction involvinig a two electron change, the standard emf of the cell is found to be 0.295 V at 25° C. The equilibrium constant of the reaction at $25^{\circ} C$ will be:

A. 1×10^{-10}

B. 2.95×10^{-2}

C. 10

D. 1×10^{10}

Answer: D

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61. Given that $E^{\circ}_{M^{+}|M}$ = -0.44V and $E^{\circ}_{X^{+}|X}$ = -0.33V at 298 K. The value of E_{cell} for,

$M_s|M^{+}(0.\ M)||X^{+}(0.2M)|X(s)at298K$

will be: $[\log 2 = 0.3, \log 3 = 0.48, \log 5 = 0.7]$

A. 0.19V

B. 0.127V

C. 0.092V

D. 0.119V

Answer: B

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62. Calcualte the EMF of the cell at 298K

$Pt|H_2(1atm)|NaOH(xM),$

$NaCl(xM)|AgCl(s)|Ag$

$E^{\circ}_{Cl^{-}|AgCl|Ag}$ = +0.222V

A. 1.048V

B. $-0.04V$

C. -0.604

D. EMF depends on x and cannotbe determined unless value of x is given

Answer: A

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63. At what $\frac{Br^{-}}{\sqrt{CO_3^{2-}}}$ does the following cell have its reaction at equilibrium?

$Ag(s)|Ag_2CO_3(s)|Na_2CO_3(aq)||KBr(aq)|AgBr(s)|Ag(s)$

$K_z9sp) = 8 \times 10^{-12}$ for Ag_(2)CO^(3) and K_(sp) = 4 xx 10^(-13)` for AgBr

A. $\sqrt{1} \times 10^{-7}$

B. $\sqrt{2} \times 10^{-7}$

C. $\sqrt{3} \times 10^{-7}$

D. $\sqrt{4} \times 10^{-7}$

Answer: B

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64. Consider the cell $Ag(s)|AgBr(s)Br^{c-}(aq)||AgCl(s), Cl^{c-}(aq)|Ag(s)$ at $298K$. The K_{sp} of $AgBr$ and $AgCl$, respectively are 5×10^{-13} and 1×10^{-10} . At what ratio of $[Br^{c-}]$ and $[Cl^{c-}]$ ions, EMF_{cell} would be zero ?

A. $1 : 200$

B. $1 : 100$

C. $1 : 500$

D. 200:1`

Answer: A

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65. Consider the reaction fo extraction of gold from its ore

$$Au + 2CN^-(aq) + \frac{1}{4}O_2(g) + \frac{1}{2}H_2O \rightarrow Au(CN)_2^- + OH^-$$

Use the following data to calculate ΔG° for the reaction

$$K_f\left[Au(CN)_2^-\right] = X$$

$$\begin{array}{llll} O_2 + 2H_2O + 4e^- \rightarrow 4OH^- & : & E^\circ = & +0.41\text{volt} \\ Au^{3+} + 3e^- \rightarrow Au & : & E^\circ = & +1.5\text{volt} \\ Au^{3+} + 2e^- \rightarrow Au^+ & : & E^\circ = & +1.4\text{volt} \end{array}$$

A. $-RTInX + 1.29F$

B. $-RT$ In X $-2.11F$

C. $-RTIn\frac{1}{X} + 2.11F$

D. $-RTInX - 1.29F$

Answer: B

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66. $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H - (2)O$,

If H^+ concentration is decreased from 1 M to 10^{-4} M at $25^\circ C$, whereas concentration of Mn^{2+} and MnO_4^- remains 1M, then:

A. The potential decreases by 0.38V with decrease in oxidising power.

B. The potential increases by 0.38 V with increase in oxidising power

C. the potential decreases by 0.25 V with decrease in oxidising power

D. the potential decreases by 0.38 V without affecting oxidising power.

Answer: A

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67. Consider the following cell reation :

$2Fe(s) + O_2(g) + 4H^{\oplus}(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l) \qquad E^{c-} = 1.67V$

$At\left[Fe^{2+}\right] = 10^{-3}M, p(O_2) = 0.1atm$ and $pH = 3$.

The cell potential at $25^\circ C$ is

A. 1.47V

B. 1.77V

C. 1.87 V

D. 1.57 V

Answer: D

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68. At equimolar concentration of Fe^{2+} and Fe^{3+}, what must $\left[Ag^{+}\right]$ be so that the voltage of the galvanic cell made from the $\left(Ag^{+}|Ag\right)$ and $\left(Fe^{3+} \mid Fe^{2+}\right.$ electrodes equals zero?

$Fe^{2+} + Ag^{+} \rightarrow Fe^{3+} + Ag$

$E^{\circ}_{Ag^{+}, Ag}$ = 0.7991, $E^{\circ}_{Fe^{3+} / Fe^{2+}} = 0.771$

A. 0.34

B. 0.44

C. 0.47

D. 0.61

Answer: A

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69. The reduction prtential of hydrgen delctrode when placed I buffer solution is fournd to be $-0.423V$. The pH of the buffer is .

A. 10

B. 4

C. 7

D. 12

Answer: C

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70. A galvanic cell is compsed of two hydrogen electrodes, one of which is a standard one. In which of the following solutions should the other electrode be immersed to get maximum emf?

$K_a(CH_3COOH) = 2 \times 10^{-5}, K_a(H_3PO_4) = 10^{-3}$.

A. 0.1 M HCl

B. 0.1 M CH_3COOH

C. 0.1 M H_3PO_4

D. 0.1 M H_2SO_4

Answer: B

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71. Calcualte ΔG° for

$Mn^{+2} + MnO_2 \xrightarrow{H^+} 2Mn^{+3} + H_2O$

Given: $E^{\circ}_{Mn^{+3}/Mn^{+2}} = 1.51V$, V, $E^{\circ}_{MnO_2/Mn^{+3}}$ = 0.95 V.

A. 237.39 kJ

B. 54 kJ

C. $-54kJ$

D. $-237.39kJ$

Answer: B

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72. In a half-cell containing $\left[Tl^{3+}\right]=0.1M$ and $\left[Tl^{+}\right]=0.01$M, the cell potential is $-1.2496V$ for the reaction $Tl^{+} \rightarrow Tl^{3+}+2e^{-}$. The standard reduction potential of the $Tl^{+3} \mid Tl^{+1}$ couple at 25°C is:

A. 144 V

B. 0.61 V

C. 2.44 V

D. 1.22 V

Answer: D

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73. For which half-reaction will a 0.1 unit increase in pH cause the greatest increases in half-cell potential?

A. $V^{2+}(aq) \rightarrow V^{3+}(aq) + 2^{-}$

B. $VO_3 + 2H^{+} \rightarrow VO_2^{-} + H_2O$

C. $VO^{2+} + 2H^{+} + e^{-} \rightarrow V_{3+} + H_2O$

D. $VO^{2+} + H_2O \rightarrow VO_2^{+} + 2H^{+} + e^{-}$

Answer: B

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74. In a concentration cell, $Zn|Zn^{2+}(0.1M)||Zn^{2+}(0.15M)|Zn$, as the cell discharges:

A. reaction proceeds to the right

B. the two solutions approach each other in concentration.

C. no reaction takes place

D. water gets decomposed.

Answer: B

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75. Use the given standard reduction potentials to determine the reduction potential for this half-reactions.

$$MnO_4^-(aq) + 3e^- + 4H^+ \rightarrow MnO_2(S) + 2H_2O(l)$$

Reaction	E°
$MnO_4^-(aq) + e^- \longrightarrow MnO_4^{2-}(aq)$	+0.564 V
$MnO_4^{2-}(aq) + 2e^- + 4H^+ \longrightarrow MnO_2(s) + 2H_2O(l)$	+2.261 V

A. 1.695 V

B. 2.825 V

C. 3.389 V

D. 5.086 V

Answer: A

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76. The standard electrode potential for the reactions,

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$

$Sn^{2+}(aq) + 2e^{-} \rightarrow Sn(s)$

at $25^{\circ}C$ are 0.80 volt and -0.14 volt, respectively. The emf of the cell $Sn|Sn^{2+}(1M)||Ag^{+}(1M)Ag$ is :

A. 0.66 volt

B. 0.80 volt

C. 1.80 volt

D. 0.94 volt

Answer: D

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77. The standard electrode potentials, E° of Fe^{3+}/Fe^{2+} and Fe^{2+}/Fe at 300 K are +0.77 V and $-0.44V$, respectively, The E° of $Fe^{3+}/Fe)$ at the same temperature is:

A. 1.21 V

B. 0.33 V

C. $-0.036V$

D. 0.036 V

Answer: C

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78. The emf of a cell corresponding to the following reaction is 0.0199 V at 298 K.

$Zn(s) + 2H^{+}(aq) \rightarrow Zn^{2+}(0.1M) + H_2(g)\left(E^{\circ}_{Zn/Zn^{2+}} = 0.76V\right.$

The approximate pH of the solution at the electrode where hydrogen is being produced is $[pH_2 = 1atm]$:

A. 8

B. 9

C. 10

D. 11

Answer: C

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79. $Ni(s) + Cu^{2+}(aq) \rightarrow Ni^{2+}(aq) + Cu(s)$

The voltaic cell based on this reaction has a voltage of 0.59 V under standard conditions. Which of these changes will produce a higher voltage?

(P) Increasing $[Cu^{2+}]$

(Q) Increasing the size of the $Ni(s)$ electrode.

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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80. For which of these oxidation/reduction pairs will the reduction potential vary with pH?

(P) $AmO_2^{2+} \mid Am^{4+}$

(R) $Am^{4+} \mid Am^{2+}$

A. P only

B. Q only

C. P and Q only

D. P,Q and R

Answer: B

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81. A variable, opposite external potential$(E_{ext}$ is applied to the cell : $Zn|Zn^{2+}(1M)||Cu^{2+}(1M)|Cu,$ of potential 1.1 V.respectively electrons flow from :

A. anode to cathode in both cases

B. anode to cathode and cathode to anode

C. cathode to anode in both cases

D. cathode to anode and anode to cathode.

Answer: B

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82. For the galvanic cell:

$Ag(s)|AgBr(aq)|Br^-(aq)||Cl^-(aq)|AgCl(s)|Ag(s)$

the value of E°_{cell} at 298 K:

[Given : K_{sp} of AgCl $= 2 \times 10^{-10}$.

K_{sp} of AgBr $= 4 \times 10^{-13} = \dfrac{2.303R \times 298}{F} = 0.06$, log 2 = 0.3]`

A. $0.00V$

B. $-0.160V$

C. $+0.162V$

D. $+0.198V$

Answer: C

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83. At 298 K, the standard reduction potential are: $1.33V$ for $Cr_2O_7^{2-} \mid Cr^{3+}$,

$1.36V$ for $Br_2 \mid Br^-$ and 0.54V for $I_2 \mid I^-$.

At pH = 4, $Cr_2O_7^{2-}$ is expected to oxidise?

Assume $\left[Cr^{3+}\right]$ = $\left[Cr_2O_7^{2-}\right]$ = 1M.

A. Cl^- and Br^-

B. Cl^-, Br, I^-

C. Br^-, I^-

D. $I^-\,only$

Answer: D

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84. Which of the given cells are concentration cells?

(P) $Pt|H_2(p_1^-)|HCl(aq)|H_2(p_2^-)|Pt$

(Q) $Ag|AgCl|KCl(aq)||KBr(aq)|AgBr|Ag$

(R) $Ag|AgCl|KCl(aq)\ |\ |AgNO_3(aq)|Ag$

(S) $Pt|Na(Hg)|Na_2SO_4(aq)|Na(Hg)|Pt$

A. Only P and S

B. Only P and Q

C. Only P, Q, R

D. Only P,R,S

Answer: A

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85. In given galvanic cell,

$Pt|H-(2)(g)|NaCl(aq)\,|\,|AgNO_3(aq)|Ag$

on adding water into L.H.S compartment, e.m.f of the cell:

A. increases

B. decreases

C. remains unchanged

D. none of these.

Answer: C

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86. At 298 K, the standard reduction potentials are 1.51 V for $MnO_4^- \mid Mn^{2+}$, $1.36V$ for $Cl^2 \mid Cl^-$, 1.07 V for $Br_2 \mid Br^-$, and 0.54 V for $I_2 \mid I^-$. At pH=3, permanganate is expected to oxidize $\left(\frac{RT}{F} = 0.059V\right)$:

A. Cl^- and Br^-

B. Cl^-,Br^- and I^-

C. Br^- and I^-

D. I^- only

Answer: C

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87. Latimer diagram for Cu in an acidic solution is:

$Cu^{+2} \xrightarrow{+0.15V} Cu^+ \xrightarrow{+0.50} Cu,$

A. $+0.65$ volt

B. $+0.325vo <$

C. $-0.0325vo <$

D. $-0.325vo <$

Answer: B

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88. The reduction of O_2 to H_2O in acidic solution has a standard reduction potential of $+1.23V$. What is the effect on the half-cell potential of $+1.23V$. What is the effect on the half-cell potential at 25°C when the pH of the solution is increased by one unit?

$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$

A. The half-cell potential decreass by 59 mV.

B. The half-cell potential increases by 59 mV.

C. The half cell potential decreases by 236 mV.

D. The half-cell potential increases by 236 mV.

Answer: A

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89. $Pt(s), H_2(g)|HCl(C_1)| \mid HCl(C_2 \mid H_2, Pt(s)$

The emf of cell is at 298 K : $\left(\frac{2.303RT}{F} = 0.6V\right)\Big)$

$[\log_2 = 0.3]$

A. 0.018 V

B. 0.18 V

C. 0.036 V

D. 0.09 V

Answer: A

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90. Given the two standard reduction potentials below, what is the K_{sp} of Ag_2CrO_4 at $25^\circ C$?

$Ag_2CrO^4(s) + 2e^- \rightarrow 2Ag(s) + CrO_4^{2-}(aq)\ E^\circ = +0.446V$

$Ag^+(aq) + e^- \rightarrow Ag(s)\ E^\circ = +0.799V$

A. 8.64×10^{11}

B. 1.08×10^{-6}

C. 1.08×10^{-12}

D. 1.11×10^{-39}

Answer: C

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91. An increase in pH will promote which of the reactions below?

(P) 2MnO_(4)^(-) + MnO_(2) + 4OH^(-) rightarrow 3MnO_(4)^(2-) + 2H_(2)O

(Q)6Cl_(2) + 2I^(-) + 6H_(2)O rightarrow 12Cl^(-) + 2IO_(3)^(-) + 1H^(+)`

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: C

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92. $Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq), E^{\circ} = 1.1V$

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s), \ E^{\circ} = -0.76V$

$Cu^{2+}(aq) + 4NH_3(aq) \rightarrow \left[Cu(NH_3)_4\right]^{2+}(aq) + 2e^{-}$ is:

A. 0.34 V

B. 0.76 V

C. 0.26 V

D. 0.14 V

Answer: C

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93. The EMF of the following cell:

$Zn|Zn^{2+}(0.1M)||Cl^-(0.01M)|AgCl \mid Ag$ is:

[Given : E_(Zn^(2+)|/Zn)^(@) = -0.76V, E_(Cl^(-)| AgCl|Ag)^(@) $= 0.22V$,

$\left.\frac{2.303RT}{F} = 0.06\right]$

A. 0.96 V

B. 0.345 V

C. 1.23

D. 1.13 V

Answer: D

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94. The standard reduction potential of $Cd^{2+}(aq)$ is $-0.402V$.

A voltaic cell described by :

$Cd(s) + 2H^+(aq) \rightarrow Cd^{2+}(aq) + H_2(aq)$

has [Cd^(2+)] = 0.900 m

and $ahydro \geq npressureof 0.975atm. Itscellpotentialat$25^(@)C

$ismeasuredas$E = +9.192V. $W\hat{i}sthepH \in the$H^(+) | H-(2)` half-cell?

A. 3.o28

B. 3.58

C. 6.54

D. 7.15

Answer: B

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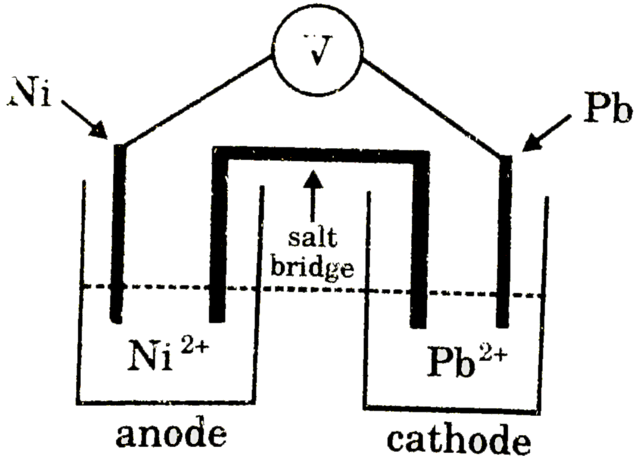
95. The cell potential for the voltaic cell depicted (according to IUPAC) below is 0.109 V under standard conditions,

$1MNi^{2+}(aq)$ and $1MPb^{2+}(aq)$

1 M $Ni^{2+}(aq)$ and 1 M $Pb^{2+}(aq)$



Which change will increase the voltage?

A. The $1 M Ni^{2+}$ solution is diluted with H_2O.

B. A larger Ni electrode is used.

C. 50 ml of 1M NaCl solution is added to precipitate of $PbCl_2$.

D. More 1 M Pb^{2+} solution is added to the half-cell.

Answer: A

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96. A standard voltaic cell is constructed using Cu metal in 1.0 M $Cu(NO_3)_2$(aq) and an unknown metal in a 1.0 M solution of its nitrate salt. The cell voltage is 0.47 V when the Cu half-cell is the cathode. What is the standard reduction potential of the unknown metal ? $\left[E^\circ_{Cu} = 0.34V\right]$

A. $-0.81V$

B. $-0.13V$

C. $0.13V$

D. $0.81V$

Answer: B

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97. $$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3=} + 4H_2O$$

$E^\circ = 0.743V$

What is the value of E for the cell based on the reaction above at $25^{\circ}C$

for the following conditons? $\begin{matrix} MnO_4^- & Fe^{2+} \\ 2.3\times10^{-2} & 1\times10^{-4}M \\ \left[Mn^{2+}\right] & Fe^{3+} \end{matrix}$

A. 0.20 V

B. 0.45 V

C. 0.64 V

D. 1.28 V

Answer: A

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98. Given the reactions and data below, what is the K value for this electrochemical cell?

$Cu|CuNO(3)(1.0M)||I^-(1.0M), I_2(1.0M)|Pt$ at 25°C.

Reaction	E° (V)
$Cu^+ + e^- \rightarrow Cu$	0.518
$I_2 + 2e^- \rightarrow 2I^-$	0.534

A. 0.288

B. 1.86

C. 2.23

D. 3.48

Answer: B

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99. A voltaic cell is constructed with the overall reaction :

$$Sn^{2+}(aq) + 2Ag^{+}(aq) \to Sn^{4+}(aq) + 2Ag(s).$$

Which change will increase the voltage of the cell?

A. increasing $[Sn^{2+}]$

B. Increasing $[Sn^{4+}]$

C. Decreasing $[Ag^{+}]$

D. Reducing the size of the Ag electrode

Answer: A

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100. Which change occurs as the chemical reaction takes place in the standard electrochemical cell represented below?

$Zn(s)|Zn^{2+}(aq)||Sn^{2+}(aq)|Sn(S)$

Reduction Half-reaction	E° (Volts at 298 K)
$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$	–0.136
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	–0.763

(P) Electrons move through the external circuit from Zn to Sn.

(Q) The concentration of `Zn^(2+)(aq) increases.

(R) The voltage increases from a negative value to zero.

A. P and Q only

B. P and R only

C. Q and R only

D. P, Q and R

Answer: A

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101. Calculate the cell potential, E, for a silver-silver chloride electrode immersed in 0.800 M KCl at 25° C

$$\left[Ag^{+}+e^{-}\rightarrow Ag,\ E^{\circ}=0.799V, K_{sp}=1.8\times10^{-10}\right]$$

A. 1.37 V

B. 0.80 V

C. 0.57 V

D. 0.23 V

Answer: D

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102. Consider a voltaic cell in which the reaction below occurs in two half-cells connected by a salt bridge and an external circuit.

$2Cr(s) + 3Sn^{2+}(aq) \rightarrow 3Sn(s) + 2Cr^{3+}(aq)E^{\circ} = 0.603V$.

Which change will cause the voltage to increase?

A. Increasing the amount of Sn(s) in its half-cell

B. increasing the amount of Cr(s) In its half-cell

C. Diluting the solution in the anode compartment

D. Diluting the solutioin In the cathode compartment

Answer: C

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103. $2Ag^{+}(aq) + Cu(s) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

The standard potential for this reaction is 0.46 V. Which change will increase the potential the most?

A. Doubling the $\left[Ag^{+}\right]$

B. Halving the $\left[Cu^{2+}\right]$

C. Doubling the size of the Cu(s) electrode.

D. Decreasing the size of the Ag electrode by one half.

Answer: A

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104. $Zn(s)\left|zn^{2+}(aq)\right|\left|H_{+}(aq)\right|H_2(g)\ E^{9}\circ\Big) = 0.76V$

What must be the pH in the hydrogen compartment of the cell designated above if the cell voltage is 0.70 V? (Assume that both the $\left[Zn^{2+}\right]$ and the $H_2(g)$ pressure are at standard values and $T = 25^{\circ}C$

A. 0.51

B. 1.01

C. 2.5

D. 3.21

Answer: B

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105. The voltage for the cell $Fe \mid Fe^{2+}(0.0010M)$ || Cu^(2+)(0.10 M) | Cu $is0.807Vat25$^(@)$C. W\hat{i}sthevalueofE^\circ$?

A. 0.51

B. 1.01

C. 2.5

D. 3.21

Answer: C

Watch Video Solution

106. For the cell

$Zn(s) + 2H^+(aq)rightarrowZn^{2+}(aq) + H_2(g), E^\circ = 0.76$V

Which change will increase the voltage of the cell?

A. increasing the size of the Zn electrode

B. increasing the $[Zn^{2+}]$

C. Increasing the $[H^{+}]$

D. increasing the pressure of the $H_2(g)$

Answer: C

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107. $2Ga(s) + 6H^{+}(aq) \rightarrow 2Ga^{3+}(aq) + 3H_2(g)$,

The potential of the cell for the reaction given is 0.54V. If the concentrations of the ions are 1.0M and the pressure of $H_2(g)$ is 1atm, what is E° for the half-reaction

$Ga^{3+}(aq) + 3e^{-} \rightarrow Ga(s)$

A. $-0.54V$

B. $-0.27V$

C. 0.27 V

D. 0.54 V

Answer: A

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108. The following cell

$Al(s) \mid Al^{3+}(aq, 0.001M) \mid \mid Cu^{2+}(aq, 0.10M) \mid Cu(s)$ has a standard cell potential, E° = 200V. What is the cell potential for this cell at the concentration given?

A. 2.07 V

B. 2.03 V

C. 1.97 V

D. 1.94 V

Answer: B

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109. For the voltaic cell respresents below

$Ni(s)|Ni^{2+}(aq)||Ag^{+}(aq)|Ag(s)$

Which change will increase the cell potential?

A. increasing the $[Ag^{+}]$

B. increasing the $[Ni^{2+}]$

C. Adding Ni(s)

D. Removing Ag(s)

Answer: A

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110. Which of the following is correct about the electrochemical cell represented here?

$Ag|Ag^{+}||NO_3^{-}, No \mid Pt$

A. NO undergoes oxidation at the anode

B. The major purpose of the Pt is to act as a catalyst.

C. The Ag electrode decreases in mass as the cell operates.

D. The voltage of the cell can be increased by doubling the size of Ag electrode.

Answer: C

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111. For the voltaic cel based on this reaction:

$2Ag^{+}(aq) + Cu \rightarrow Cu^{2+}(aq) + 2Ag$

The concentration of the aqueous ions and sizes of the electrodes can be changed independently. Which statement is correct?

A. Increasing the [Cu^2+)] two fold has the same effect on the cell voltage as increasing the $[Ag^{+}]$ four-fold.

B. Decreasing the $[Cu^{2+}]$ two-fold has the same effect on the cell voltage as increasing the $[Ag^{+}]$ by the same factor.

C. Decreasing the $[Cu^{2+}]$ ten-fold has less effect on the cell voltage than decreasing the $[Ag^{+}]$ by the same factor.

D. Doubling the sizes of the cathode has exactly the same effect on the cell voltage as decreases the $[Cu^{2+}]$ by a factor of two.

Answer: C

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112. What is the $[Fe^{2+}]$ in a cell at $25^{\circ}C$ for which E = -0.458V with a standard hydrogen electrode?

$Fe^{2+}(aq) + 2e^{-} \rightarrow Fe(s)\ E^{\circ} = -0.440V$

A. 0.246 M

B. 0.496 M

C. 2.01 M

D. 4.06 M

Answer: A

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113. $Sn(s)|Sn^{2+}(aq)||Cu^{2+}(aq)|Cu(s)$

For the voltaic cell represented above, which change will increase the voltages?

A. Increasing the size of the Sn electrode

B. Increasing the size of the Cu electrode

C. Increasing the $[Sn^{2+}]$

D. Increasing the $[Cu^{2+}]$

Answer: D

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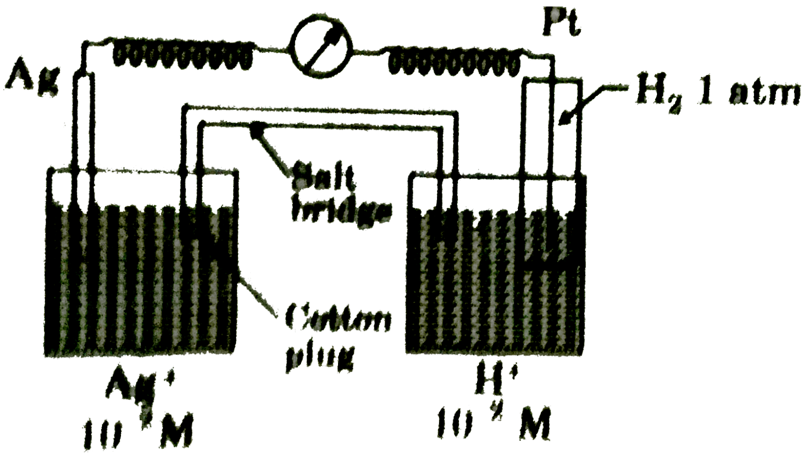
114. Calculate emf of given cell at $25^{\circ} C$:



[Given: $E^{\circ}_{Ag^{+}/Ag}\Big) = 0.80V\Big]$

A. $+0.80V$

B. 0.12 V

C. $-0.178V$

D. 1.04 V

Answer: A

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115. The standard reduction potential for $H^{+}(aq)$ is 0.00v. What is the reduction potential for a 1×10^{-3} M HCl solution?

A. 0.355 V

B. 0.178 V

C. -0.178 V

D. 0.355V

Answer: C

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116. Under what conditions is the Nernst equation used to calcualte cell potential voltages in a voltaic cell?

A. Non standard concentration only

B. non-spontaneous reactions only

C. Reactions at equilibrium only

D. Reactions of ions with the same charges only

Answer: A

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117. Which is a consistent set of values for a specific redox reaction carried out under standard conditions?

	E°	ΔG°	**Description**
(a)	+	−	Spontaneous
(b)	−	+	Spontaneous
(c)	+	+	Non-spontaneous
(d)	−	−	Non-spontaneous

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Batteries

1. The overall reaction for the lead storage batter when it discharges is:

$$Pb(s) + PbO_2(s) + 4H^+(aq) + 2SO_{94})^{2-}(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$$

(P) PbSO_(4) is formed only at the cathode.

(Q) The density of the solution decreases.

Which statements correctly describes the battery as its discharges?

A. P only

B. Q only

C. both P and Q

D. neither P not Q

Answer: B

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2. The advantage of methane fuel cells over internal combusion engines (ICEs) that burn methane include which of the following?

(P) Methane fuel cells are less polluting.

(Q) Methane fuel cells are more efficient.

(R) Methane fuel cells are less expensive.

A. P only

B. P and Q only

C. Q and R only

D. P, Q and R

Answer: B

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3. Rechargable batteries include which of the those below?

(P) Dry cell

(Q) Lead-acid storage battery

(R) Nickel -cadmium battery

A. Q only

B. P and Q only

C. Q and R only

D. P,Q and R only

Answer: C

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4. During discharge of a lead storage cell the density of sulphuric acid in the cell:

A. increases

B. decreases

C. remains unchanged

D. initially increases but decreases subsequently

Answer: C

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5. In $H_2 - O_2$ fuel cell the reaction occurring at cathode is:

A. $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$

B. $2H_2 + O_2 \rightarrow 2H_2O(l)$

C. $H^+ + OH^- \rightarrow H_2O$

D. $H^+ + e^- \rightarrow \frac{1}{2}H_2$

Answer: A

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6. In a $H_2 \rightarrow O_2$ fuel cell, 6.81 L of hydrogen at STP reacts in 15 minutes, the average current produced in amperes is:

A. 64.3 amp

B. 643.3 amp

C. 6.43 amp

D. 0.643 amp

Answer: A

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7. While charging the lead storage battery:

A. $PbSO_4$ anode is reduced to Pb.

B. $PbSO_4$ cathode is reduced to Pb.

C. $PbSO_4$ anode is oxidised to Pb

D. $PbSO_4$ anode is oxidised to PbO_2

Answer: A

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8. Equivalent weight of H_2SO_4 in the following reaction $(Pb(s) + PbO_2(s) + H_2SO_4 \rightarrow PbSO_4 + H_2O$ is

A. 98

B. 49

C. 196

D. 80

Answer: A

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9. Which of the processes happen during the discharging of a lead storage battery?

(P) H_2(g) is produced

(Q)PbO_2 is converted to $PbSO_4$

(R) The density of the electrolyte solution decreases.

A. P only

B. Q only

C. P and R only

D. Q and R only

Answer: D

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10. The equation for one of the half-reactions in a lead storage battery is :

$$PbO-(2)+4H^{+}+SO_4^{2-}+2e^{-}\rightarrow PbSO_4+2H_2O$$

What happens to the properties of the electrolyte as this

	Density	pH
(a)	increases	increases
(b)	increases	decreases
(c)	decreases	decreases
(d)	decreases	increases

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Thermodynamics in Electrochemistry

1. The temperatuer coefficient, of the emf, i.e., $\frac{dE}{dt} = -0.00065$ Volt deg^{-} for the cell, $Cd|CdCl_2(1M)||AgCl(s)|Ag$ at 25°.

Calcualte the entropy changes ΔS_{298K} for the cell reaction,

$Cd + 2AgCl \rightarrow Cd^{2+} + 2Cl^{-} + 2Ag$

A. $-105.5JK^{-}$

B. $-150.2JK^{-}$

C. $-75.7JK^{-}$

D. $-125.5JK^{-}$

Answer: D

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2. The standard emf of the cell.

$Cd(s) \mid CdCl_2(aq) \rightarrow 2Ag(s) + Cd^{2+}(aq) + 2Cl^{-}(aq)$ is 0.6915 V at 0° and 0.6753 V at $25^{\circ}C$. The ΔH° of the reaction at $25^{\circ}C$ is:

A. $-176kJ$

B. $-234.7kJ$

C. $+123.5kJ$

D. $-167.25kJ$

Answer: D

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3. ΔG° of the cell reaction

$AgCl(s)+\frac{1}{2}H_2 \rightarrow Ag(s)+H^{+}+Cl^{-}$ is $-21.52kJ$.

ΔG° of 2AgCl(s) + H_(2)(g) rightarrow + 2H^(+) + 2Cl^(-)` is

A. $-21.52kJ$

B. $-10.76kJ$

C. $-43.04kJ$

D. $43.04kJ$

Answer: C

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4. The emf of the cell $Zn | ZnCl_2$ (0.05M) | AgCl(s)

, $Agis1.015Vat298K$ and $thetemperaturecoefficientofitsemfis$-4.92

xx 10^(-4)$\frac{V}{K}$. $Howmanyofthereactionther \mod ynamicparameter$

DeltaG, DeltaS and DeltaH` are negative at 298 K?

A. None of them

B. One of them

C. Two of them

D. All of them

Answer: B

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5. The Gibbs energy for the decomposition of Al_2O_3 at $500^\circ C$ is as follow

:

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2, \Delta_r G = \ +960kJmol^{-1}$$

The potential difference needed for the electrolytic reduction of aluminium oxide (Al_2O_3) at $500^\circ C$ is

A. 4.5 V

B. 3.0 V

C. 2.5 V

D. 5.0 V

Answer: C

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6. Calculate the cell EMF in mV for

$Pt|H_2(1atm)|HCl(0.01M)\ |\ |AgCl(s)|Ag(s)$ at 298 K

if $\triangle G_1^\circ$ values are at $25^\circ C$

$-109.56\frac{kJ}{mol}$ for $AgCl(s)$ and

$-130.79\frac{kJ}{mol}$ for $(H^+ + Cl^-)(ag)$

(A). 456 mV

(B). 654 mV

(C). 546 mV

(D). None of these

A. 456 mV

B. 654 mV

C. 546 mV

D. 338 mV

Answer: A

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7. What is cell entropy change of the following cell?

$Pt(s)|H_2(g)|CH_3COOH, HCl||KCl(aq)|Hg_2Cl_2(s)|Hg$

P = 1atm, 0.1 M, 0.1M

EMF of the cell is found to be

$0.045 v at 298 K$ and $temperature coefficient is$ 34 xx 10^(-4)VK^(-1) $Given$

K_(a(CH_(3)COOH)) = 10^(-5) M`

A. 60

B. 65.6

C. 69.2

D. 63.5

Answer: B

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8. At 298 K the standard free energy of formation of $H_2O(l)$ is $-237.20k\frac{J}{\text{mole}}$ while that of its ionisation into H^+ ions and hydroxyl ions is $80k\frac{J}{\text{mole}}$, then the emf of the following cell at 298 K will be :

[Take 1F = 96500 C]

$H_2O(g, 1^-)|H^+(1M)||OH^-(1M)|O_{92})(g, 1^-)$

A. 0.40 V

B. 0.81 V

C. 1.23 V

D. $-0.40V$

Answer: A

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9. The potential of the Daniel cell, $Zn|(ZnSO_4)| \mid (CuSO_4 \mid Cu$ was reported by Buckbee, Surdzial and Metz as $E^\circ = 1.1028 - 0.641 \times 10^{-3}T + 0.72 \times 10^{-5}T^2$, where T is the temperature in degree celcius, Calcualte $\Delta S^{\circ 0}$ for the cell reaction at $25^\circ C$.

A. $-45.32EU$

B. $-34.53EU$

C. $-25.43EU$

D. $54.23EU$

Answer: D

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10. Using the data in the preceding problem, calcualte the equilibrium constant of the reaction at $25^\circ C$.

$$Zn + CU^{2+} \rightarrow Zn^{2+} + Cu \ K = \frac{Zn^{2+}}{(Cu^{2+}]}$$

A. 9.85×10^{24}

B. 4.831×10^{31}

C. 9.85×10^{36}

D. $4.831x10^{44}$

Answer: C

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11. $\Delta G = \Delta H - T\Delta S$ and $\Delta G + T\left[\frac{d(\Delta G)}{dT}\right]_p$ then $\left(\left(d\frac{E_{cell}}{dT}\right)\right.$ is:

A. $\frac{\Delta S}{nF}$

B. $\frac{nF}{\Delta S}$

C. $-nFE_{cell}$

D. $+nEF_{cell}$

Answer: A

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12. ΔG is the available energy (energy produced) during the electochemical reaction in galvanic cell which can be converted into useful work. In the light of second law of thermodynamics, in the cell, the change in electrode potential with temperature will be equal to:

A. $\Delta S \frac{)}{nF}$

B. $\frac{nF}{\Delta S}$

C. -2.303 RT log K_c

D. $\dfrac{-2.303RT}{nF}$

Answer: A

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13. At 298 K the standard free energy of formation of H_2O (l) is -237.20 kJ/"mole" while ΔG° of its ionisation into H^{+} ion and hydroxyl ionosis $80kJ/\text{mole}$, then the emf of the following cell at 298 K will be:

$H - 92)(g, 1^{-})|H^{+}(1M)||OH^{-}(1M)|O_2(g, 1^{-})$

A. 0.40 V

B. 0.81 V

C. 1.23 V

D. $-0.40V$

Answer: A

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Watch Video Solution

14. ΔG° of the cell reaction

$AgCl(s) + \frac{1}{2}H_2 \rightarrow Ag(s) + H^{+} + Cl^{-}$ is $-21.52kJ$.

ΔG° of 2AgCl(s) + H_(2)(g) rightarrow + 2H^(+) + 2Cl^(-)` is

A. -43.04kj

B. -40 kj

C. -30 kj

D. 20 kj

Answer: A

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15. The EMF of an electrolytic cell does not depend upon:

A. valency of reacting material used in cell

B. concentration of metal ion present in the electrolyte soution

C. quantity of electrolytic solution used in the cell

D. temperature of elecrolytic cell

Answer: C

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16. For the reaction:

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l),$

$\Delta G^\circ = -2.108 \times 10^3 kJmol^-$

What is the value of of the standard electrode potential, E° for a fuel cell based on this reaction?

A. 1.09 V

B. 2.18 V

C. 4.37 V

D. 21.8 V

Answer: A

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17. $Ag^{aq} + e^{-} \rightarrow Ag(s)\ E69 \circ) = 0.80V$

$Mg^{2+}(aq) + 2e^{-} \rightarrow Mg(s)\ E^{\circ} = -2.73V$

Use the equations above to calcualte the value or $\Delta G^{\circ 0}$ (in kJ/mol) for the reaction:

$Mg(s) + 2Ag^{+}(aq) \rightarrow Mg^{2+}(aq) + 2Ag(s)$

A. 681

B. 341

C. -341

D. -681

Answer: D

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18. What is the ΔG° value for the electrochemical cell below?

$Cu(s)|Cu^{2+}(aq)||NO_3^-(aq)|NO(s) \mid Pt(s)$

Half-Reaction	E°, V
$NO_3^-(aq) + 4H^+(aq) + 3e^- \to NO(g) + 2H_2O(l)$	0.960
$Cu^{2+}(aq) + 2e^- \to Cu(s)$	0.340

A. -753 kJ

B. -359 kJ

C. -179 kJ

D. -59.8 kJ

Answer: B

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19.

$10Cl^-(aq) + 2MnO_4^-(aq) + 16H^+(aq) \to 5Cl_2(g) + 2Mn^{2+}(aq) + 8H_2$

The value of E° for this reaction at $25^\circ C$ is 0.15 V. What is the value of K for this reaction?

A. 2.6×10^{25}

B. 4.9×10^{12}

C. 1.3×10^{5}

D. 3.4×10^{2}

Answer: A

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20. The standard potential for the reaction,

$Cl_2(g) + 2Br^-(aq) \rightarrow Br_2(l) + 2Cl^-(aq)$ is 0.283 volts. What is the equilibrium consant for this reaction at 25°C?

A. 1.6×10^{-5}

B. 22

C. 6.1×10^{4}

D. 3.9×10^9

Answer: D

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21. What is the approximate value of the equilibrium constant, K_{eq}, at 25°C for the reaction,

$3Ag^+(aq) + Cr(s) \rightarrow Cr^{3+}(aq) + 3Ag(s)$

Standard Reduction	Potential, V
$Ag^+(aq) + e^- \rightarrow Ag(s)$	+0.80
$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$	–0.74

A. 10^{22}

B. 10^{26}

C. 10^{33}

D. $2 \cdot 10^{78}$

Answer: D

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22. $3Ni^{2+} + 2Al \rightarrow 2Al^{3+} + 3Ni, E^{\circ 0 = 1.41 V}$

For the reaction given, which expression gives the value of ΔG° in $kJmol^{-}$?

A. $\frac{-3 \times 96.5}{1.41}$

B. `(-6 xx 96.5)/(1.41)

C. $-3 \times 96.5 \times 1.41$

D. $-6 \times 96.5 \times 1.41$

Answer: D

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Faraday s Laws and Electrolysis

1. How many faradays are required to reduce one "mole" of $MnO-(4)^{-}$ to Mn^{2+} ?

A. 1

B. 2

C. 3

D. 5

Answer: D

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2. Three faradays of electricity was passed through an aqueous solution of iron (II) bromide. The mass of iron metal (at mass 56) deposited at the cathode is:

A. 56 g

B. 84 g

C. 112 g

D. 168 g

Answer: B

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3. One g equivalent of Na metal is formed from electrolyis of fused NaCl. No of "mole" of Al from the fused $Na_3AlF-(6)$ with the same current passed is:

A. 1

B. 3

C. $\frac{1}{3}$

D. 2

Answer: C

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4. A current of 2 A was passed for $1h$ through a solution of $CuSO_4$. $0.237g$ of Cu^{2+} ions was discharged at cathode . The current efficiency is .

A. 42.24%

B. 26.1%

C. 10%

D. 40.01%

Answer: C

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5. With t taken in seconds and I taken in amp, the variation of I follows the equation $t^2 + I^2 = 25$

What amount of Ag will be electrodeposited with this current flowing in the interval 0-5 second? (Ag=108)

A. 22 mg

B. 66 mg

C. 77 mg

D. 88 mg

Answer: A

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6. An acidic solution of copper (II) sulphate can be stored in iron vessel.

A. Fe

B. Zn

C. H_2

D. Alloy of Zn and Fe

Answer: C

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7. Which statement is correct?

A. A solution of copper (II) sulphate can be stored in iron vessel.

B. An oxide layer on zinc vessel can be easily removed by washing with dilute HCl.

C. Molten $PbBr_2$ is good conductor of electricity because it contains free ions.

D. In the reaction, $Li + \frac{1}{2}H_2 \rightarrow LiH$, hydrogen is a reducing agent.

Answer: C

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8. Which one of the following statements is not true?

A. The conjuate base of $H_2PO_4^-$ is HPO_4^{2-}

B. pH + pOH = 14 for all aqueous solutions at 25° C.

C. The pH of 1×10^{-8} M HCl is 8

D. 96,500 coloumbs of electricity when passed through a $CuSO_4$ solution deposits 1 gm equivalent of copper at the cathode.

Answer: C

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9. A current is passed through 2 voltmeters connected in series. The first voltmeter contians $XSO-94)(aq)$ and second has Y_2SO_4(aq). The relative atomic masses of X and Y are in the ratio $2:1$. The ratio of the mass of X liberated to the mass of Y liberated is:

A. $1:1$

B. $1:2$

C. $2:1$

D. none of these

Answer: A

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10. How many gm of silver will be displaced from a solution of $AgNO_3$ by 4gm of magnesium?

A. 18gm

B. 4gm

C. 36 gm

D. 16gm

Answer: C

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11. The number of electrons required to deposit 1g equivalent aluminium (At. Wt. =27) from a solution of aluminium chloride will be

A. 3

B. 1

C. 4

D. 2

Answer: B

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12. Aluminium oxide may be electrolysed at 1000°C to furnish aluminium metal (Atomic mass = 27 amu, 1 Faraday = 96500 Coulomb). The cathode reaction is $Al^{3+} + 3e^{-} \rightarrow Al$. To prepare 5.12 kg of aluminium metal by this method would require:

A. 5.49×10^{7} C of electricity

B. 1.83×10^{7} C of electricity

C. 5.49×10^{4} C of electricity

D. 5.49×10^{10} C of electricity

Answer: A

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13. The number of electrons delivered at the cathode during electrolysis by a current of 1 ampere in 60 seconds is (charger on electron $= 1.60 \times 10^{-19} C$)

A. 3.74×10^{20}

B. 6.0×10^{23}

C. 7.48×10^{21}

D. 6.0×10^{20}

Answer: A

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14. How many electrons flow when a current of 5 amperes is passed through a conductor for 200 seconds?

A. 6.241×10^{21}

B. 6.0241×10^{21}

C. 6.241×10^{22}

D. 6.0241×10^{20}

Answer: A

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15. Which process occurs in the electrolysis of an aqueous tin (II) chloride solution at a tin anode?

A. Sn = $Sn^{2+} + 2e^{-}$

B. $2Cl^{-} = Cl_2 + 2e^{-}$

C. $2H_2O = O_2 + 4H^{+} + 4e^{-}$

D. None of these

Answer: A

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16. What must be concentration of Ag^{+} in an aqueous solution containing $Cu^{2+} = 1.0M$ so that bot the metals can be deposited on the cathode simultaneously. Given that $E^{0}_{Cu/Cu^{2+}} = -0.34V$ and $E^{0}_{Ag^{+}/Ag} = 0.812V, T = 298K$

A. Nearly 10^{-19} M

B. 10^{-12} M

C. 10^{-8} M

D. Nearly 10^{-16} M

Answer: C

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17. Cost of electricity for the production of X litre H_2 at STP at cathode is Rs. X, then cost of electricity for the production of X litre O_2 gas at STP at anode will be :(assume 1 "mole" of electrons as one unit of electricity)

A. 2X

B. 4X

C. 16 X

D. 32 X

Answer: A

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18. The reaction :

$$Zn(s) + 2AgCl(g) \rightarrow ZnCl_2(aq) + 2Ag(s)$$

occurs in the cell $Zn \mid ZnCl_2$ (1M solution), AgCl(s) | Ag. The number of Faradays required from the external source for this reaction to occur in the cell is:

A. 2

B. 3

C. 1

D. zero

Answer: D

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19. Electrolysis of a solution of HSO_4^{-1} ions produces $S_2O_8^{2-}$. Assuming 75% current efficiency, what current should be employed to achieve a production rate of 1 "mole" of $S_2O_8^{2-}$ per hour?

A. $+71.5$ amp

B. 35.7 amp

C. 142.96 amp

D. 285.93 amp

Answer: A

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20. During an electrolysis of conc H_2SO_4 , perdisulphuric acid $(H_2S_20_8)$ and O_2 are formed in equimolar amount. The moles of H_2 that will be formed simultaneously will be

a. Thrice that of O_2 b. Twice that of O_2

c. Equal to that of O_2. d. Half of that of O_2

A. Thrice that of O_2 in "mole"s

B. Twice that of O_2 in "mole"s

C. Equal to that of O_2 in "mole"s

D. Half that of O_2 in "mole"s

Answer: A

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21. the standard reduction potenital of a silver chloride electrode is 0.2 V and that of a silver electrode is 0.79 V. The maximum amount of AgCl that can dissolve in 10^6L of a 0.1 M $AgNO_3$ solution is:

A. 0.5 mmol

B. 1.0 mmol

C. 2.0 mmol

D. 2.5 mmol

Answer: B

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22. A cell $Cu|Cu^{2+}|\,|\,Ag^+|Ag$ initially contains 2 M Ag^+ and 2 M Cu^{2+} ions in 1 L electrolyte. The magnitude of change in potential after charging the cell by passage of 10 amp current for 4825 sec at 298 K is:

A. 0.0074 V

B. 1.0074 V

C. 0.0038 V

D. 0.0089 V

Answer: A

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23. $Na -$ amalgam is prepared by electrolysis of $NaCl$ solution using liquid Hg as cathode . How long should the current of $10 amp$. Is passed to produce $10\% \ Na - Hg$ on a cathode of $10 gm Hg$. (atomic mass of $Na = 23$).

A. 7.77 min

B. 9.44 min

C. 5.24 min

D. 11.39 min

Answer: A

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24. A very thin copper plate is electro $-$ plated with gold using gold chloride in HCl. The current was passed for $20 min$. And the increase in the weight of the plate was found to be $2g$. $[Au = 197]$. The current passed was $-$

A. 0.816 amp

B. 1.632 amp

C. 2.449 amp

D. 3.264 amp

Answer: C

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25. A current of 4.0 A is passed for 5 hours through 1 L of 2 M solution of nickel nitrate using two nickel electrodes. The molarity of the solution at the end of the elelctrolysis will be:

A. 1.5 M

B. 1.2 M

C. 2.5 M

D. 2.0 M

Answer: D

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26. A current of 9.65 ampere is passed through the aqueous solution $NaCI$ using suitable electrodes for $1000s$. The amount of $NaOH$ formed during electrolysis is

A. 2.0 g

B. 4.0 g

C. 6.0 g

D. 8.0 g

Answer: B

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27. In the electrolysis of an aqueous potassium sulphate solution, the PH of the solution in the space near an electrode increased. Which pole of the current source is the electrode connected to ?

A. The positive pole

B. Could be either pole

C. The negative pole

D. Cannot be determined

Answer: C

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28. When the sample of copper with zinc impurityn is to be purified by electrolysis, the appropriate electrode are .

A. pure zinc as cathode and pure copper as anode

B. impure sample as cathode and pure copper as anode

C. impure zinc as cathode and impure sample as anode

D. pure copper as cathode and impure sample as anode.

Answer: D

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29. During the electrolysis of 0.1 M $CuSO_4$ solution using coppepr electrodes, a depletion of $[Cu^{2+}]$ occurs near the cathode with a corresponding excess near the anode, owing to inefficient stirring of the solution. If the local concentration of $[Cu^{2+}]$ near the anode and cathode are respectively 0.12 M and 0.08 M, calcualte the back emf developed. Temperature = 298 K.

A. 22 mV

B. 5.2 mV

C. 29 mV

D. 59 mV

Answer: B

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30. In an electrolyitc cell of Ag/NO_3Ag, when current is passed, the concentration of $AgNO_3$.

A. increases

B. decreases

C. remains same

D. none of these

Answer: C

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31. If 0.024 L of H_2 gas is formed at the cathode, the volume of O_2 gas formed at the anode under identical conditions, is:

A. 0.224 L

B. 0.448 L

C. 0.112 L

D. 1.12 L

Answer: C

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32. A current of 0.1 A was passed for 2 hr through a solution of cuprocyanide and 0.3745 g of copper was deposited on the cathode. Calculate the current efficiency for the copper deposition. (Cu = 63.5)

A. $79\ \%$

B. $39.5\ \%$

C. $63.25\ \%$

D. $63.5\ \%$

Answer: A

View Text Solution

33. 5.6 amp

A. 7.2 amp

B. 8.85 amp

C. 11.2 amp

D.

Answer: C

View Text Solution

34. The electrice charge for eeletrode deposition of $1g$ equivalent of a substance is

A. one amp/sec

B. 96,500 C/sec

C. one amp/hour

D. 96,500 C

Answer: D

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35. A solution of sodium sulphate in qater is electrolysed using inert electrodes, The products at the cathode and anode are respectively.

A. H_2, O_2□

B. O_2, H_2

C. O_2, Na

D. O_2, SO_2

Answer: A

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36. In the electrolysis of an aqueous nickel (II) sulphate solution, the process $2H_2O = 2O_2 + 4H^+ + 4e^-$ occurs at the anode. The material of construction of the anode may be:

A. nickel

B. gold

C. copper

D. none of these

Answer: B

Watch Video Solution

37. By the electrolysis of aqueous solution of $CuSO_4$, the products obtained at both the inert electrodess are:

A. O_2 at anode and H_2 at cathode.

B. H_2 at anode and Cu at cathode

C. O_2 at anode and Cu at cathode

D. $H_2S_2O_8$ at anode and O_2 cathode.

Answer: C

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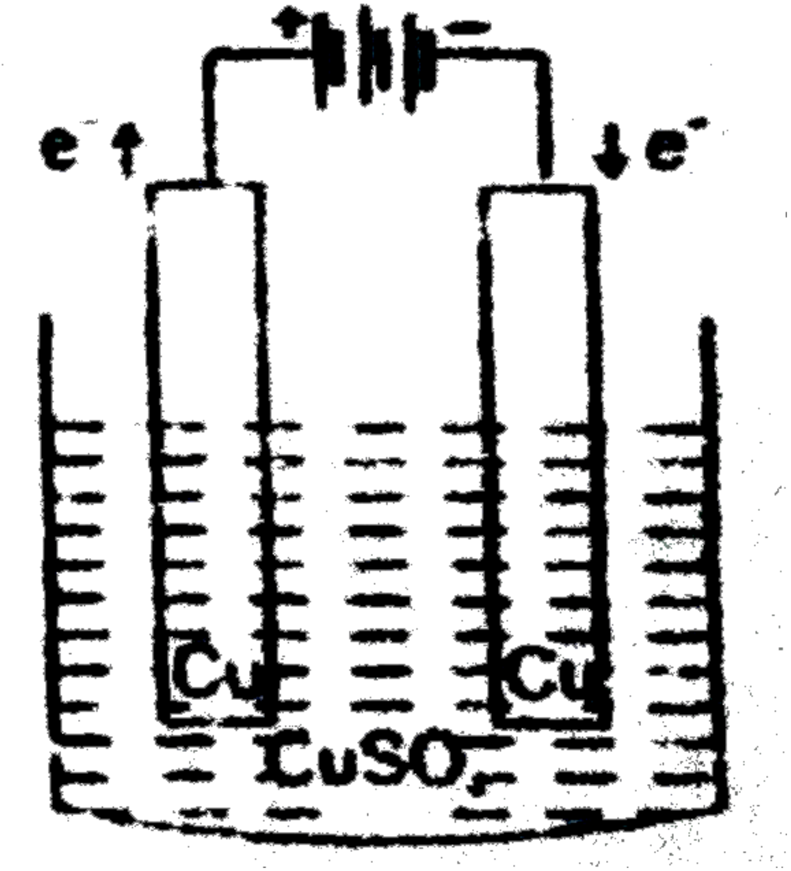
38. In the given figure the electrolytic cell contains $1L$ of an aqueous $1M$ Copper (II) sulphate solution. If 0.4 mole of electrons passed through of cell, the concentration of copper ion after passage of the charge will be



A. 0.4 M

B. 0.8 M

C. 1.0 M

D. 1.2 M

Answer: C

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39. Aqueous solution of Na_2SO_4 containing a small amount of HPh is electrolysed using Pt-electrodes. The colour of the solution after some time will:

A. remains colourless

B. change from pink to colourless

C. change from colourless to pink

D. remain pink

Answer: A

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40. What happens to a certain during the electrolysis of a molten salt?

The cation moves towards the:

A. Anode and undergoes reduction

B. anode and undergoes oxidation

C. cathode and undergoes reduction

D. cathode and undergoes oxidation

Answer: C

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41. The passage of a constant current through a solution of dilute H_2SO_4 with 'Pt' electrodes liberated $340.5cm^3$ of a mixture of H_2 and O_2 at S.T.P. The quantity of electricity that was passed is:

A. 96500 C

B. 965 C

C. 1930 C

D. (1/100) Faraday

Answer: C

View Text Solution

42. The current of 5A deposited 1.517 g of Pt in 10 min from a solution of a platinum salt. The equivalent mass of platinum is therefore:

A. 48.8 g/eq

B. 97.6 g/eq

C. 146.4 g/eq

D. 195.2 g/eq

Answer: A

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43. For the electrolytic production of $NaClO_4$ from $NaClO_3$ as per the following equation:

$NaClO_3 + H_2O \rightarrow NaClO_4 + H_2$

How many faradays of electricity will be required to produce 0.5 "mole" of $NaClO_4$ assuming 60% efficiency?

A. 0.835 F

B. 1.67 F

C. 3.34 F

D. 1.6 F

Answer: B

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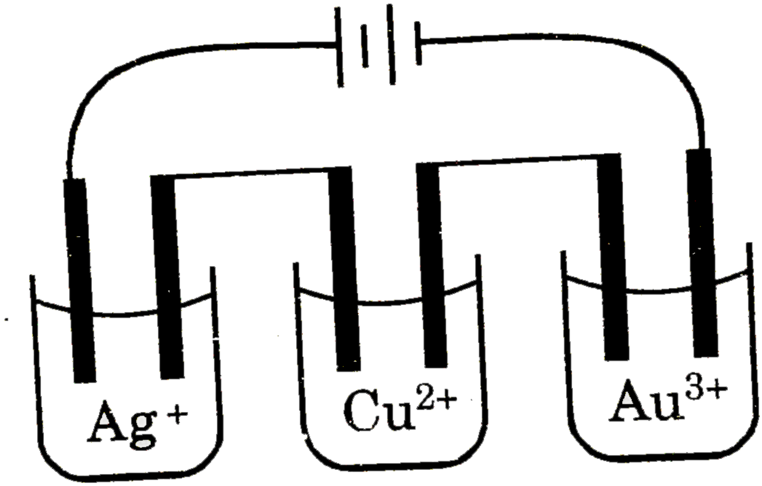
44. 1.0 M aqueous solutions of $AgNO_3, Cu(NO_3)_2$ and $Au(NO_3)_3$ are electrolyzed in the apparatus shown, so that same amount of electricity passes through each solutions. If 0.10 mols of solid Cu are formed how many "mole"s of Ag and Au are formed?



A. 0.10 "mole"s Ag, 0.10 "mole"s Au

B. 0.05 "mole"s Ag, 0.075 "mole"s Au

C. 0.05 "mole"s Ag, 0.15 "mole"s Au

D. 0.10 "mole"s Ag, 0.067 "mole"s Au

Answer: D

View Text Solution

45. Number of electrons lost dring electrolysis of $0.355g$ of Cl^{c-} is $(N_A =$ Avogadro's number $)$

A. 0.01

B. 0.01 N_0

C. $0.02N_0$

D. $\frac{0.01}{2N_0}$

Answer: B

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46. Electrolysis of a solution of $MnSO_4$ in aqueous sulphuric acid is a method for the preparation of MnO_2. Passing a current of 27 A for 24 hours gives 1 kg of MnO_2. The current efficiency in this process is:

A. 1

B. 0.9509

C. 0.8

D. 0.8295

Answer: B

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47. An alloy of lead (Valency = 2) and thallium (valency = 1) containing 65% Pb and 35% Tl, by weight, can be electroplated onto a cathode from a solution. How many gram of this alloy will deposi in 9.65 hours using a constant current os 0.5 amp?

[Given that only these two elements deposit simultaneously in given mass ratio at cathode]

[Atomic weight Pb = 208, Tl = 200]

A. 3.7 gm

B. 22.5 gm

C. 37.1 gm

D. 24.9 gm

Answer: B

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48. During the preparation of $H_2S_2O_8$ (per disulphuric acid) O_2 gas also releases at anod as byproduct, when 9.85 L of H_2 releases at cathode and 2.38 L $O-(2)$ at anode at STP, the weight of $H_2S_2O_8$ produced in gram is:

A. 87

B. 43.5

C. 83.42

D. 48.5

Answer: B

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49. A current of 9.95 amp following for 10 minutes, deposits 3 gm of a metal. Equivalent weight of the metal is:

A. 12.5

B. 18.5

C. 21.5

D. 51.74

Answer: D

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50. Four moles of electrons were transferred from anode to cathode in an experiment on electrolysis of water. The total volume of the tow gases (dry and at STP) produced will be approximately (in litres)

A. 22.7

B. 45.4

C. 67.2

D. 68.1

Answer: D

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51. Electrolytic reduction of 6.15 g of nitrobenzene using a current efficiency of 40% will require which of the following quantity of electricity? [C =12, H=1, N=14,O=16]

A. 0.75 F

B. 0.15 F

C. 0.75 C

D. 0.125C

Answer: A

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52. A certain current liberates $0.5g$ of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time in a copper sulphate solution ?

A. 31.8 g

B. 16.0 g

C. 12.7 g

D. 63.5 g

Answer: B

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53. All of the following affect the number of "mole"s of metal deposited during electrolysis except the:

A. current used

B. electrolysis time

C. charge on the ion

D. atomic mass

Answer: B

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54. What is the amount of chlorine evoled when 2 amperes of current is passed for 30 minumtes in an aqueous solution of $NaCI$?

A. 9.81 g

B. 1.32 g

C. 4.56 g

D. 12.6

Answer: B

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55. A spoon to be electroplated with gold should be placed at:

A. cathode

B. anode

C. electrolyte

D. none of these

Answer: A

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56. The two aqueous solutions, $A(AgNO_3)$ and $B(LiCI)$, were electrolysed using Pt electrodes. The pH of the resulting solutions will.

A. increase in A and decrease in B

B. decrease in both

C. increase in both

D. decrease in A and increase in B

Answer: D

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57. Time required to deposit one milli"mole" of aluminium metal by the passage of 9.65 amp through aqueous solution of aluminium ion is:

A. 30 s

B. 10 s

C. 30,000 s

D. 10,000s

Answer: A

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58. Which of the following statement is not correct about an inert electrode in a cell?

A. It does not participate in the cell reaction.

B. It provides surface either for oxidation or for reduction reaction.

C. It provides surface for conduction of electrons.

D. It provides surface for redox reaction.

Answer: B

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59. During the electrolysis of aqueous zinc nitrate.

A. Zn plates out at the cathode

B. Zn plats out at the anode

C. H_2 gas is evolved at the anode

D. O_2 gas is evolved at the anode.

Answer: D

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60. A currrent of 5.0 A flows for 4.0 h through an electrlytic cell containing a molten salt of metalM. This results in deposition of 0.25 mol of the metal M at the cathode. The oxidation state of M in the molten salt is : (1 Faraday=$96485C\text{mol}^{-1}$)

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61. Which statement is not true about the electrolysis of a 1 M solution of Kl to which phenolphthalein has been added?

A. Potassium metal is formed.

B. A yellow colour appears at the anode

C. A pink colour appears at the cathode.

D. A gas is produced at the cathode.

Answer: A

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62. When water is electrolysed, hydrogen and oxygen gas are produced. If 1.008 g of H_2 is liberated at the cathode. What mass of O_2 is formed at the anode?

A. 32.0g

B. 16.0g

C. 8.00g

D. 4.00g

Answer: C

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63. How many "mole"s of electrons must be removed from each "mole" of toulene, $C_6H_5CH_3$. When it is oxidized to benzoic acid, C_6H_6COOH?

A. 1

B. 2

C. 4

D. 6

Answer: D

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64. $H_2(g)$ is produced industrially by electrolysis of aq. NaCl using inert electrodes. How many ampere-hours would be required for production of 20kg hydrogen?

A. 5.36×10^5

B. 1.07×10^6

C. 2.68×10^5

D. 1.93×10^5

Answer: A

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65. How many Faradays are required to reduce all the chromium in 0.150L of 0.115 M of $Cr_2O_7^{2-}$ to Cr^{2+}?

A. 0.920F

B. 0.690F

C. 0.138F

D. 0.069F

Answer: C

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66. An aqueous solution of $CuSO_4$ is electrolyzwed for 1.50 hours with a current of 2.50 amps. What mass of copper metal is formed?

A. 8.88g

B. 4.44g

C. 0.296g

D. 0.0741g

Answer: B

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67. A steady current of 1.20 ampere is passed through a solution of MCl_x for 2 hours and 33 minutes. If 2.98 g of metal M is plated out, what is the identity of the metal?

A. Al

B. Cr

C. Ni

D. Zn

Answer: B

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68. If aq. $CuCl_2$ solution is electrolysed by using Cu electrodes then products obtained at cathode and anode respectively are:

A. $Cl_2(g), H_2(g)$

B. $H_2(g), Cl_2(g)$

C. $Cu^{2+}, H_2(g)$

D. Cu, Cu^{2+}

Answer: D

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69. An electrolysis cell is operated for 3000 a using a current of 1.50A. From which 1.0M solution will the greatest mass of metal be deposited?

A. $TiNO_3$

B. $Pb(NO_3)_2$

C. $ZnCl_2$

D. $In(NO_3)_3$

Answer: A

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70. Aluminium is produced commercially by the electrolysis of Al_2O_3. How many hours would be required to produce 250 g of Al usinga 5.00 ampere current?

A. 49.7

B. 149

C. 745

D. 4020

Answer: B

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71. How many liters of chlorine gas, Cl_2, measured at $0^\circ C$ and 1 atm are released by the passage of 6.25 amperes for 1.85 hours through molten magnesium chloride?

A. 0.0805L

B. 0.161L

C. 4.83L

D. 9.67L

Answer: C

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72. For how many seconds must a current of 5.00 A flow in order to deposit 1.30g of nickel from a solution of nickel(II) nitrate? (Coulumbs=Amperes xx seconds)

A. 2.14×10^2

B. 4.28×10^2

C. 8.65×10^2

D. 4.28×10^3

Answer: C

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73. It takes 126.5 minutes using a current of 5.15 A to deposit all of the nickel from 225mL of a solution contaiing Ni^{2+}. What was the original concentration of Ni^{2+} in the solution?

A. 3.60M

B. 1.80M

C. 0.900M

D. $1.50 \times 10^{-2} M$

Answer: C

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74. A current of 0.0965 ampere is passed for 1000 seconds through 50mL of 0.1M NaCl, using inert electrodes the average concentration of OH^{-} in the final solution is:

A. 0.1M

B. 0.02M

C. 0.03M

D. 0.04M

Answer: B

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75. When a current of 0.25 ampere is passed through excess of molten MCl_x for half an hour, 0.45gm of metal M (atomic mass=193) is deposited at the cathode. The value ofg x is:

A. 1

B. 2

C. 3

D. 4

Answer: B

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76. In an electrolytic cell the electrode at which the electrons enter the solution and the chemical change that occurs at this electrode are called respectively as:

A. anode, oxidation

B. anode,reduction

C. cathode, oxidation

D. cathode, reduction

Answer: D

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77. A solution containing equimolar amounts of $NiCl_2$ and $SnBr_2$ is electrolyzed using a 9V battery and graphite electrodes. What are the first products formed.

Standard Reduction Potential (V)	
$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$	-0.236
$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$	-0.141
$Br_2(aq) + 2e^- \rightarrow 2Br^-(aq)$	1.077
$Cl_2(aq) + 2e^- \rightarrow 2Cl^-(aq)$	1.360

A. Ni(s) at cathode, $Cl_2(aq)$ at anode

B. Ni(s) cathode, $Br_2(aq)$ at anode

C. Sn(s) at cathode, $Br_2(aq)$ at anode

D. Sn(s) at cathode, $Cl_2(aq)$ at anode

Answer: C

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78. A current of 2.0A is used to plate Ni(s) from 500mL of a 1.0M Ni^{2+} (aq) solution. What is the $[Ni^{2+}]$ after 3.0 hours?

A. 0.39m

B. 0.46m

C. 0.78m

D. 0.89m

Answer: C

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79. What occurs when an aqueous solution of Na_2SO_4 containing several drops of phenolphthalein is electrolyzed between Pt electrodes?

A. The colourless solution turns pink at the anode but remains colurless at the cathode.

B. The colourless solution turns pink at the cathode but remains colourless at the anode.

C. The pink solution becomes colourless at the anode but remains pink at the cathode.

D. none of the above

Answer: B

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80. A current of 12A is used to plate nickel from a $Ni(NO_3)_2$ solution. Both Ni(s) and $H_2(g)$ are produced at the cathode. If the current efficiency with respect to the formation of $Ni(s)$ is 62%, how many grams of nickel are plated on the cathode in 45minutes?

A. 0.1

B. 6.1

C. 9.9

D. 12

Answer: B

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81. A 3.00amp current is used to electrolyze the molten chlorides, $CaCl_2$, $MgCl_2$, $AlCl_3$ and $FeCl_3$. The deposition of which mass of metal will require the longest electrolysis time?

A. 100g Ca

B. 50g Mg

C. 75g Al

D. 125g Fe

Answer: C

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82. The deposition of 1.0g of which element from its molten chloride requires the shortest time at a current of 1A?

A. Na

B. Mg

C. Al

D. Ba

Answer: D

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83. Chromium metal can be produced by the electrolysis of molten CrO_3. What current in amperes operating for 100 minutes is needed to produce 104 grams of this metal?

A. 193

B. 96.5

C. 64.3

D. 32.2

Answer: A

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84. Which reaction occurs at the cathode during electrolysis of an aqueous solution of KCl?

A. $k^{+}(aq) + e^{-} \rightarrow K(S)$

B. $2H_2O(l) + 2e^{-} \rightarrow H_2(g) + 2OH^{-}(aq)$

C. $2Cl^{-}(aq) \rightarrow Cl_2(g) + 2e^{-}$

D. $2H_2O(l) \rightarrow O_2(g) + 4H^{+}(aq) + 4e^{-}$

Answer: B

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85. When an aqueous solution of potassium fluoride is electrolyzed, which of the following occurs

A. O_2 and H^{+} are produced at one electrode and H_2 and OH^{-} are formed at the other.

B. O_2 and OH^{-} are produced at one electrode and H_2 and H^{+} are formed at the other.

C. Metallic K is formed at one electrode and O_2 and H^+ are formed at the other.

D. Metallic K is produced at one electrode and elemental F_2 is produced at the other.

Answer: A

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86. Given the standard reduction potentials.

$$\begin{array}{ll} O_2 + 4H^+ + 4e^- \rightarrow 2H_2O & E^\circ = 1.23V \\ Br_2 + 2e^- \rightarrow 2Br^- & E^\circ = 1.08V \\ 2H^+ + 2e^- \rightarrow H_2 & E^\circ = 0.00V \\ Na^+ + e^- \rightarrow Na & E^\circ = -2.71V \end{array}$$

What products are formed in the electrolyss of 1M NaBr in a solution with $[H_3O^+] = 1M$?

A. Na(s) and $O_2(g)$

B. Na(s) and $Br_2(g)$

C. $H_2(g)$ and $Br_2(g)$

D. $H_2(g)$ and $O_2(g)$

Answer: C

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87. In a battery with a zinc anode, what is the 250mA is drawn for 12.0 minutes?

A. 0.0610g

B. 0.122g

C. 0.244g

D. 1.02g

Answer: A

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Conductance and Kohlrausch s law

1. The ionization constant of a weak electrolyte is 2.5×10^{-5}, while of the equivalent conductance of its $0.1M$ solution is $19.6scm^2eq^{-1}$. The equivalent conductance of the electrolyte at infinite dilution is :

A. 250

B. 196

C. 392

D. 384

Answer: C

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2. Which has the maximum conductivity ?

A. $[Cr(NH_3)_3Cl_3]$

B. $[Cr(NH_3)_4Cl_2]Cl$

C. $[Cr(NH_3)_5Cl]Cl_2$

D. $\left[Cr(NH_3)_6Cl_3\right.$

Answer: D

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3. Molar conductance of $BaCl_2$, H_2SO_4 and HCl at infinite dilutions are x_1, x_2 and x_3, respectively. Equivalent conductance of $BaSO_4$ at infinite dilution will be:-

A. $\frac{[x_1 + x_2 - x_3]}{2}$

B. $\frac{[x_1 - x_2 - x_3]}{3}$

C. $2(x_1 + x_2 - 2x_3)$

D. $\frac{[x_1 + x_2 - 2x_3]}{2}$

Answer: D

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4. The specific conductivity of a saturated solution of AgCl is $3.40 \times 10^{-6} ohm^{-1} cm^{-1}$ at $25^{\circ} C$. If $\lambda_{Ag^+ = 62.3 ohm^{-1} cm^2 \text{mol}^{-1}}$ and $\lambda_{Cl^-} = 67.7 ohm^{-1} cm^2 \text{mol}^{-1}$, the solubility of AgC at $25^{\circ} C$ is:

A. $2.6 \times 10^{-5} M$

B. $4.5 \times 10^{-3} M$

C. $3.6 \times 10^{-5} M$

D. $3.6 \times 10^{-3} M$

Answer: A

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5. The conductivity of saturated solution of $BaSO_4$ is $3.06 \times 10^{-6} ohm^{-1} cm^{-1}$ and its equivalent conductance is 1.53 $ohm^{-1} cm^2 \text{equiv}^{-1}$. The K_{sp} for $BaSO_4$ will be:

A. 4×10^{-12}

B. 2.5×10^{-13}

C. 25×10^{-9}

D. 10^{-6}

Answer: D

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6. Molar conductance of 0.1 M acetic acid is 7 $ohm^{-1}cm^2\mathrm{mol}^{-1}$. If the molar conductance of acetic acid at infinite dilution is 280 $ohm^{-1}cm^2\mathrm{mol}^{-1}$, the value of dissoication constant will be:

A. $226 \times 10^{-5} moldm^{-3}$

B. $1.66 \times 10^{-3} moldm^{-3}$

C. $1.66 \times 10^{-2} moldm^{-3}$

D. $6.25 \times 10^{-5} moldm^{-3}$

Answer: D

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7. The conductivity of a saturated solution of Ag_3PO_4 is $9 \times 10^{-6} Sm^{-1}$ and its equivalent conductivity is $1.50 \times 10^{-4} Sm^{-2}$ equivalent $\hat{}\ (-1)$.

A. 4.32×10^{-18}

B. 1.8×10^{-9}

C. 8.64×10^{-13}

D. None of these

Answer: A

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8. The limiting molar conductivities Λ° for $NaCl, KBr$ nd KCl are 126,152 and 150 S $cm^2 \text{mol}^{-1}$ respectively. The Λ° for NaBr is:

A. $128 Scm^2 \text{mol}^{-1}$

B. $176 Scm^2 \text{mol}^{-1}$

C. $278 Scm^2 \text{mol}^{-1}$

D. $302 Scm^2 \text{mol}^{-1}$

Answer: A

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9. We have taken a saturated solution of $AgBr, K_{sp}$ of AgBr is 12×10^{-14}. If 10^{-7} "mole" of $AgNO_3$ are added to 1 litre of this solution then the conductivity of this solution in terms of $10^{-7} Sm^{-1}$ units will be: [Given: $\lambda^{\circ}_{(Ag^+)} = 4 \times 10^{-3} Sm^2 \text{mol}^{-1}, \lambda^{\circ}_{(Br^-)} = 6 \times 10^{-3} Sm^2 \text{mol}^{-1}, \lambda^{\circ}_{(NO_3^-)} =$]

A. 39

B. 55

C. 15

D. 41

Answer: A

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10. For saturated solution of CaF_2, choose the correct relationship:

A. `A_(mCaF_(2))^(oo)=lambda_(eq_(Ca^(2+))^(oo))+2lambda_(eq_(F^(o+))^(

B. $A^{\infty}_{mCaF_2} = 2\left(\lambda_{eq^{\infty}_{Ca^{2+}}} + \lambda^{\infty}_{eqF^{\oplus}}\right)$

C. $A^{\infty}_{mCaF_2} = \frac{1}{2}\left(\lambda^{\infty}_{eq_{Ca^{2+}}} + 2\lambda^{\infty}_{eqF^{\oplus}}\right)$

D. $A^{\infty}_{mCaF_2} = \frac{1}{2}\left(\lambda^{\infty}_{eq_{Ca^{2+}}} + \lambda^{\infty}_{eq^{\oplus}_{F}}\right)$

Answer: B

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11. The limiting molar conductivity of KCl, KMO_3 and $AgNO_3$ are 149.9,145.0 and 133.4 S $cm^2 \text{mol}^{-1}$, respectively at $25^{\circ}C$. The limiting molar conductivity of AgCl at the same temperature in S $cm^2 \text{mol}^{-1}$ is:

A. 128.5

B. 138.3

C. 161.5

D. 253.3

Answer: B

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12. Which of the statements about solution of electrolytes is not correct?

A. conductivity of solution depends upon size of ions.

B. Conductivity depends upon viscosity of solution.

C. Conductivity does not depend upon solvation of ions present in solution.

D. Conductivity of solution increases with temperature.

Answer: C

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13. A^{∞}_{AgCl} can be obtained:

A. by extrapolation of the graph A and $\sqrt{C}$ to zero concentration.

B. by known values of A^{∞} of $AgNO_3$,HCl and HNO_3

C. both a and b

D. None of these

Answer: C

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14. Which has maximum vlaue of A_{eq} at constant temperature assuming 100% ionisation of each electrolyte?

A. 0.1M HCl

B. 0.1M NaCl

C. 0.1 M KCl

D. Equal

Answer: A

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15. Conductivity k, is equal to ....

A. $R.\left(\frac{l}{A}\right)$

B. $\frac{G^{\oplus}}{R}$

C. A_m

D. $\frac{l}{A}$

Answer: B

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16. The conductivity of 0.2M methanoic acid is $8 Sm^{-1}$. Then, degree of dissociation for methanoic acid is: [Given : $\lambda^{\circ}_{(H^+)} = 350 Scm^2 \mathrm{mol}^{-1}, \lambda^{\circ}_{HCOO^-} = 50 Scm^2 \mathrm{mol}^{-1}$]

A. 10^{-1}

B. 10^{-3}

C. 10^{-5}

D. 10^{-7}

Answer: A

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17. Ionisation constant of a weak acid (HA) in terms of A_m^{∞} and A_m is:

A. $K_a = \dfrac{CA_m^{\infty}}{(A_m - A^{\infty})}$

B. $k_a = \dfrac{CA_m^2}{A_m^{\infty}(A_m^{00} - A_m)}$

C. $K_a = \dfrac{C(A_m^{\infty})^2}{A_m^{\infty}(A_m^{\infty} - A_m)}$

D. None of these

Answer: B

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18. Ionic conductances of H^{+} and SO_4^{2-} at infinite dilution are x and y S $cm^2 \text{equiv}^{-1}$. Hence, equivalent conductance of H_2SO_4 at infinite dilution is:

A. x+y

B. $2(x+y)$

C. $2x+y$

D. $x+2y$

Answer: A

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19. A saturated solution in AgA $\left(K_{sp}=3\times10^{-14}\right)$ and AgB $\left(K_{sp}=1\times10^{-14}\right)$ has conductivity of $375\times10^{-10}Scm^{-1}$ and limiting molar conductivity of Ag^{+} and A^{-} are 60S $cm^2\text{mol}^{-1}$ and 80 S $cm^2\text{mol}^{-1}$ respectively , then what will be the limiting molar conductivity of B^{-} (in $Scm^2\text{mol}^{-1}$)?

A. 150

B. 180

C. 190

D. 270

Answer: D

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20. 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. $LiCl > KCl > NaCl$

Answer: B

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21. The highest electrical conductivity of the following aqueous solutions is of

A. 0.1 M acetic acid

B. 0.1M chloroacetic acid

C. 0.1 M fluoroacetic acid

D. 0.1 M difluoroacetic acid

Answer: D

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22. The molar conductivities Λ°_{NaOAc} and Λ°_{HCI} at infinite dilution is watter at $25^{\circ}C$ are 91.0 and $426.2Scm^{\circ}$ / mol respectively. To calculate Λ^{2}_{HOAc}, the additional value required is:

A. $A^{\circ}_{H_2O}$

B. A°_{KCl}

C. A°_{NaOH}

D. A°_{NaCl}

Answer: D

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23. In an electrolytic cell, the flow of electrons is form

A. cathode to anode in solution

B. cathode to anode through external supply

C. cathode to anode through internal supply

D. anode to cathode through internal supply

Answer: C

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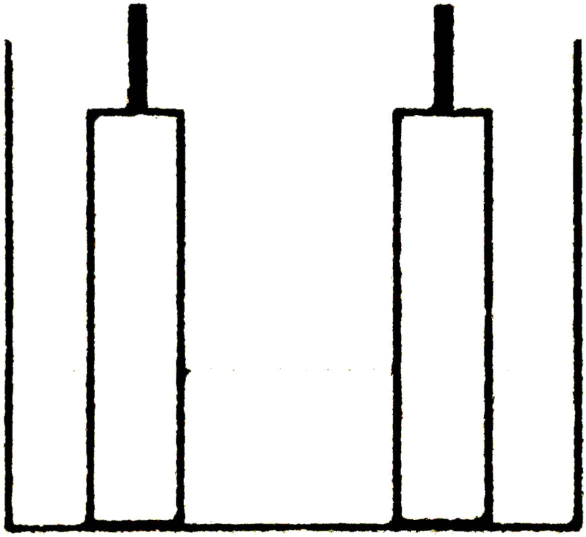
24. A resistance of 50Ω is registered when two electrodes are suspended into a beaker containing a dilute solution of a strong electrolyte such that exactly half of them are submerged into solution as shown in figure. If the solution is diluted by adding pure water (negligible conductivity) so as to just completely submerge the electrodes, the new ressitance offered by the solution would be: ltbegt



A. 50Ω

B. 100Ω

C. 25Ω

D. 200Ω

Answer: A

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25. Calculate the value of $\Lambda_m^{\propto}$ for $SrCl_2$ in water at $25^{\circ}C$ from the following data :

$Conc. (mol / lt)$	0.25	1
$\Lambda_m(\Omega^{-1}cm^2mol^{-1})$	260	250

A. 270

B. 260

C. 250

D. 255

Answer: A

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26. For a saturated solution of AgCl at $25^{\circ}C, k = 3.4 \times 10^{-6}ohm^{-1}cm^{-1}$ and that of H_2O (l) used is $2.02 \times 10^{-6}ohm^{-1}cm^{-1}$, λ_m° for AgCl is 138 $ohm^{-1}cm^2\text{mol}^{-1}$ then the solubility of AgCl in "mole"s per litre will be:

A. 10^{-5}

B. 10^{-10}

C. 10^{-14}

D. 10^{-16}

Answer: A

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27. Equal volumes of 0.015 M CH_3COOH and 0.0015M NaOH are mixed together. What would be molar conductivity of mixture if conductity of CH_3COONa is $6.3 \times 10^{-4} Scm^{-1}$?

A. $8.4 Scm^2 \text{mol}^{-1}$

B. $84 Scm^2 \text{mol}^{-1}$

C. $4.2 Scm^2 \text{mol}^{-1}$

D. $42 Scm^2 \text{mol}^{-1}$

Answer: B

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28. The specific conductance of a N/10 KCl at $25^{\circ}C$ is 0.0112 $ohm^{-1}cm^{-1}$. The resistance of cell contaiing solution at the same temperature was found to be 55 ohms. The cell contant will be:

A. $6.16cm^{-1}$

B. $0.616cm^{-1}$

C. $0.0616cm^{-1}$

D. $616cm^{-1}$

Answer: B

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29. Resistance of a conductvity cell filled with a solution of an electrolyte of concentration 0.1 M is 100 Ω. The conductivity of this solution is 1.29 Sm^{-1}. Resistance of the same cell when filled with 0.02M of the same solution is 520Ω. the molar conductivity of 0.02M solution of the electrolyte will be:

A. $124 \times 10^{-4} Sm^2 \text{mol}^{-1}$

B. $1250 \times 10^{-4} Sm^2 \text{mol}^{-1}$

C. $1.24 \times 10^{-4} Sm^2 \text{mol}^{-1}$

D. $12.4 \times 10^{-4} Sm^2 \text{mol}^{-1}$

Answer: A

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30. The equivalent conductance of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at $25^\circ C$ are given below:

$A^{\circ}_{CH_3COONa} = 91.0Scm^2 / \text{equiv}$

$A^{\circ}_{HCl} = 426.25cm^2 / \text{equiv}$

What additional information/quantity one needs to calculate A° of an aqueous solution of acetic acid?

A. The limiting equivalent conductance of $H^{+}(\lambda^{\circ}_{H^{+}})$

B. A° of chloroacetic acid $(ClCH_2COOH)$

C. A° of NaCl

D. A° of CH_3COOK

Answer: C

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31. Equivalent conductance of 1M CH_3COOH is $10ohm^{-1}cm^2\text{equiv}^{-1}$ and that at inifinite dilution is 200 $ohm^{-1}cm^2\text{equiv}^{-1}$. Hence, % ionisation of CH_3COOJ is:

A. 0.05

B. 0.02

C. 0.04

D. 0.01

Answer: A

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32. Acetic acid is titrated with NaOH solution. Which of the following statement is correct for this titration?

A. Conductance increases upto equivalence point, then it decrease

B. Conductance increases upto equivalnce point, then it increases.

C. First conductance increases slowly upto equivalence point and then increases rapidly.

D. First conductane increases slowly upto equivalence point and then drops rapidly

Answer: C

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33. The equivalent conductivity of KCl at inifinite dilution is 130 S $cm^2 eq^{-1}$. The transport number of Cl^- ion in KCl at the same temperature is 0.505. The limiting ionic mobility of K^+ ion, is:

A. $6.67 \times 10^{-4} \sec^{-1} vo <^{-1}$

B. $5.01 \times 10^{-3} cm^2 \sec^{-1} vo <^{-1}$

C. $3.22 \times 10^{-4} cm^2 \sec^{-1} vo <^{-1}$

D. $2.00 \times 10^{-4} cm^2 \sec^{-1} vo <^{-1}$

Answer: A

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34. A conducting cel is filled with 0.1 M NaCl solution. Its resistance is found to be 100 Ω whereas its conductivity is $10^{-4} Scm^{-1}$. When the same cell is filled with $0.01 MKCl$. Solution, the resistance is found to be 50Ω. Calculate molar conductance of 0.01 M KCl solution.

A. $2Scm^2 / mo \leq$

B. $20Scm^2 / mo \leq$

C. $200Scm^2 / mo \leq$

D. $100Scm^2 / mo \leq$

Answer: B

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35. Which 0.10M aqueous solutin exhibits the lowest electrical conductivity?

A. NH_4Cl

B. $CuBr_2$

C. Na_2CO_3

D. C_2H_6OH

Answer: D

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36. The molar conductivity of weak monobasic acid (HA) at infinite dilution is $50 \times 10^{-2} \Omega^{-1} cm^{-2} \text{mol}^{-1}$. The pH of 0.02M weak monobasic acid (HA) solution, whose molar conductivity is $25 \times 10^{-2} \Omega^{-1} cm^{-2} \text{mol}^{-1}$ is:

A. 1

B. 2

C. 3

D. 4

Answer: B

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37. Kohlrausch law states that:

A. For strong electrolyte, molar conductane varies linearly with concentration of electrolyte.

B. At infinite dilution, each ion makes definite contribution to molar conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.

C. At all concentraion, each ion makes definite contribution to molar conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.

D. Molar conductance increases with decrease in concentration.

Answer: B

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38. The following data is obtained at $25^\circ C$, for an aqueous solution of NaCl

{:("Conc.(in molarity)",0.25,0.64),(A_(m)("in" ohm^(-1)m^(2)"mol"^(-1)),0.025,0.019):}At25^(@)C`, the molar conductivity of 0.49M aqueous NaCl solution is:

A. $0.022 ohm^{-1} m^2 \text{mol}^{-1}$

B. $0.021 ohm^{-1} m^2 \text{mol}^{-1}$

C. $0.020 ohm^{-1} m^2 \text{mol}^{-1}$

D. $0.213 ohm^{-1} m^2 \text{mol}^{1-}$

Answer: B

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39. Select the correct statement.

A. Standard potential of electrode changes with change in concentration of electrolyte.

B. In a galvanic cell, net reaction occurring is always redox.

C. Molten NaCl is a good conductor because of presence of mobile electrons.

D. Solid NaCl is a good conductor of electricity.

Answer: B

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40. Which 0.10M aqueous solution exhibits the lowest electrical conducivity?

A. $HC_2H_3O_2(aq)$

B. $HNO_3(aq)$

C. $NH_4C_2H_3O_2(aq)$

D. $Ca(NO_3)_2(aq)$

Answer: A

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Reasoning type

1. Statement-1: The electrode potential of SHE is zero only at $25^\circ C$ and not at any other temperature.

Statement-2: SHE is standard reference electrode.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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2. Statement-1: Absolute value of E°_{red} of an electrode cannot be determined.

statement-2: Neither oxidation nor reduction can take place alone.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-2

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-2

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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3. The questions consist of two atatements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses :

$E^{\circ}_{\text{cell}} = 0$ for a chloride ion concentration cell .

For this concentration cell where $E_{\text{cell}} = \frac{\text{RT}}{\text{nF}} In \frac{[Cl^{-}]_{LHS}}{[Cl^{-}]_{RHS}}$.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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4. The questions consist of two atatements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses :

Ig $\left(\frac{dE_{cell}}{dT}\right)_p > 0$ for a cell reaction then ΔS is positive .

$\Delta S = nFT\left(\frac{dE}{dT}\right)_p$.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-4

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-4

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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5. Statement-1: If an aqueous solution of NaCl is electrolysed the product obtained at the cathode is H_2 gas notn Na.

Statement-2: Gases are liberated faster than the metals during the electrolysis of an electrolyte.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-5

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-5

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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6. The questions consist of two atatements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses :

When 2 faraday of electricity is passed through $0.1 M H_2SO_4(aq)$, 11.2 liter O_2 evolved at STP.

Molecular weight of oxygen is 32.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-6

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-6

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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7. Statement-1: Gold chloride $(AuCl_3)$ solution cannot be stored in a vessel made of copper, iron, nickel, chromium, zinc or tin.

Statement-2 Gold is a very precious metal.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-7

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-7

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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8. Statement-1: Copper is dissolved at anode and deposited at cathode when Cu electrodes are used and electrolyte is 1M $CuSO_4$ (aq) solution.

Statement-2: SOP of Cu is less than SOP of water and SRP of Cu is greater than SRP of water.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-8

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-8

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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9. Statement-1: Molar conductivity of a weak electrolyte at inifinite dilution cannot be dtermined experimentally.

Statement-2: Kohlrausch law helps to find the molar conductivity of a weak electrolyte at infinite dilution.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-9

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-9

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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10. Statement-1: Molar conductivity increases with decrease in concentration for weak electrolytes.

Statement-2: No. of ions per unit volume decreases due to dilution.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-10

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-10

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. Statement-1: Conductivity always decreases with decrease in concentration of both the weak and strong electrolytes.

Statement-2: No. of ions per unit volume linearly decreases in both electrolytes.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-11

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-11

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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12. Statement-1: Zn cannot be obtained by the electrolysis of mixture of aqueous $ZnCl_2$, $AgNO_3$ and $CuSO_4$.

Statement-2: Standard oxidation potential of Zn is higher than that of Ag and Cu.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-12

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-12

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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13. Statement-1: Molar conductance of any electrolyte increases with dilution.

Statement-2: With dilution number of ions per mL of the solution decreases.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-13

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-13

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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14. Statement-1: Equivalent conductance increases when 1 mL (1M) solution of sodium acetate is injeced into a water bulb having 90 mL of H_2O.

Statement-2: Degree of ionization increases with dilution.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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15. Statement-1: Electric work output is maximum when the electrochemical cell is in a equilibrium state.

Statement-1: Maximum work can be obtained when the process is raversible and reaches equilibrium.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-15

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-15

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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16. Statement-1: Salt bridge maintains electrical neutrality in two half cells.

Statement-2: Salt bridge transfer ions of one solution into other solution.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-16

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-16

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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17. Statement-I: In electrolysis the quantity needed for depositing 1 mole of silver is different from that required for 1 mole of copper.

Because Statement-II: The molecular weights of silver and copper are different.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-17

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-17

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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18. Assertion (A): Sodium ions are discharged in preference to hydrogen ions at a mercury cathode.

Reason (R): The nature of cathode can affect the order of discharge of cations.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-18

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-18

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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19. Statement-1: Identification of cathode and anode is done by the use of galvanometer.

Statement-1: Higher is the value of reduction potential, greater would be its reducing power.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-19

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-19

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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20. Statement-1: Zinc displaces copper from copper sulphate solution.

Statement-2: The E°_{298} of Zn is -0.76 volts and that of Cu is +0.34 volts.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-20

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-20

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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21. Statement-1: Equivalent conductance of all electrolytes decreases with increaseing concentration.

Statement-2: Number of ions are equal at per gm equivalent of strong electrolyte.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-21

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-21

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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22. Assertion $(A):$ Galvanized iron does not rust.

Reason $(R): Zn$ has a more negative electrode potential than Fe.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-22

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-22

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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23. Statement-1: On increasing dilution, the specific conductance keeps on increasing.

Statement-2: On increasing dilution. Degree of ionization of weak electrolyte ncreases and mobility of ions also increases.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-23

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-23

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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24. Statement-1: During electrolysis of H_2SO_4, H_2 and O_2 are liberated under normal concentrations and $H_2S_2O_8$ at higher concentrations and lower temperature.

Statement-2: Liberation of H_2 and O_2 at elecrode requires some potential drop known as overvoltage.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-24

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-24

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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25. Statement-1: For the reaction:

$Ni^{2+} + 2e^- \rightarrow Ni$ and $Fe^{2+} + 2e^- \rightarrow Fe$

$\Rightarrow E^\circ_{Fe^{2+} \mid Fe} < E^\circ_{Ni^{2+} \mid Ni}$ and $E^\circ_{\text{Red}} > 0$

$\Rightarrow$ So Fe electrode is cathode and Ni electrode is anode.

Statement-2: If $\Delta G^{\circ} < 0$ and $E^{\circ}_{\text{Cell}} < 0$, then , cell is feasible.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-25

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-25

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: B

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26. Statement-1: The voltage of mercury cell remains constant for long period of time.

Statement-2: It is because net cell reaction does not involve active species.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-26

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-26

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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27. Statement-1: The SRP of three metallic ions A^{+}, B^{2+}, C^{3+} are $-0.3, -0.5, 0.8$ volt respectively, so oxidising power of ions is $C^{3+} > A^{+} > B^{2+}$

Statement-2: Higher the SRP. Higher the oxidising power.

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-27

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-27

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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28. Statement-1: We can add the electrode potential in order to get electrode potential of net reaction.

Statement-2: Electrode potential is an intensive

A. Statement-1 is True, Statement-2 is True : Statement-2 is a correct explanation for Statement-28

B. Statement-1 is True, Statement-2 is True : Statement-2 is NOT a correct explanation for Statement-28

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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Multiple objective type

1. Which of the following statements is wrong about galvanic cells?

A. Cathode is the positive electrode.

B. Cathode is the negative electrode.

C. Electrons flow from cathode to anode in the external circuit.

D. Reduction occurs at cathode.

Answer: B::C

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2. Given

$$E^{\circ}_{Ag^{+}\,/\,Ag} = 0.80V, E^{\circ}_{Mg^{2+}\,/\,Mg} = -2.37V,$$

$$E^{\circ}_{Cu^{2+}\,/\,Cu} = 0.79E^{\circ}_{Hg^{2+}\,/\,Hg} = 1.71V$$

Which of the following statements is/are correct?

A. $AgNO_3$ can be stored in copper vessel

B. $Mg(NO_3)_2$ can be stored in copper vessel

C. $CuCl_2$ can be stored in silver vessel

D. $HgCl_2$ can be stored in copper vessel

Answer: B::C

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3. Any redox reaction would occur spontaneously, if:-

A. the free energy change (ΔG) is negative

B. the ΔG° is positive

C. the cell at be e.m.f. (E°) is negative

D. the cell e.m.f. is positive

Answer: A::D

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4. Fe is reacted with $1.0 M HCI. E^\circ$ for $Fe/Fe^{2+} = +0.34$ volt. The correct observation (s) regarding this reaction is/are:

A. Fe will be oxidised to Fe^{2+}

B. Fe^{2+} will be reduced to Fe

C. since e.m.f > 0, the reaction shall occur

D. since e.m.f. > 0, the reaction shall not occur

Answer: A::C

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5. Three moles of electrons are passed through three solutions in succession containing $AgNO_3, CuSO_4$ and $AuCI_3$ respectively. The molar ratio of amounts of cations reduced at cathode will be:-

A. $1:2:3$

B. $\frac{1}{1}:\frac{1}{2}:\frac{1}{3}$

C. $3:2:1$

D. $6:3:2$

Answer: B::D

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6. On electrolysis in which of the following, O_2 would be liberated at the anode?

A. Dilute H_2SO_4 with Pt electrodes

B. Aqueous $AgNO_3$ solution with Pt electrodes

C. Dilute H_2SO_4 with Cu electrodes

D. Aqueous NaOH with a Fe cathode and a Pt anode

Answer: A::B::D

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7. When a lead storage battery is discharged.

A. $PbSO_4$ is formed

B. Pb is formed

C. SO_2 is consumed

D. `H_(2)SO_(4) is consumed

Answer: A::D

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8. When a cleaned strip of zinc metal is placed in a solution of $CuSO_4$, a spontaneous reaction occurs, which of the following observation(s) is/are made?

A. The mass of zinc metal decreases gradually

B. The copper metal starts depositing on either zinc plate or settles donw in the vessel

C. The solution remains electrically neutral

D. The temperature of the solution decreases as it is an endothermic reaction.

Answer: A::B::C

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9. During electrolysis of aqueous $CuBr_2$ using Pt electrode,

A. Br_2 gas is evolved at the anode

B. $Cu(s)$ is deposited at the cathode.

C. Br_2 gas is evolved at anode and H_2 gas at cathode

D. H_2 gas is evolved at anode

Answer: A::B

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10. A current of $2.68A$ is passed for 1.0 hour through an aqueous solution of $CuSO_4$ using copper electrodes.

Which of the following statements is $/$ are correct ?

A. Increase in mass of cathode=3.174g

B. Decrease in mass of anode=3.174g

C. No change in masses of electrodes

D. The ratio between the change of masses of cathode and anode is 1:2

Answer: A::B

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11. Mark out the correct statement(s).

A. Copper metal cannot reduce iron (II) ions in acidic solutions.

B. Sodium can be obtained by the electrolysis of aqueous solution of NaCl using Pt electrodes.

C. The current carrying ions in an electrolytic cell are not necessarily discharged at the electrodes.

D. Cations having more negative oxidation potential than -0.828 V are reduced in preference to water.

Answer: A::C::D

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12. Mark out the correct statement(s) regarding electrolytic molar conductivity.

A. It increases as temperature increases.

B. It experiences resistance due to vibration of ion at the mean position.

C. Increase in concentration decreaes the electrolytic molar conductivity of both the strong as well as the weak electrolyte.

D. Greater the polarity of solvent, greater is the electrolyte molar conduction.

Answer: A::C::D

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13. If same quantity of electricity is passed through three electrolytic cells containing $FeSO_4$, $Fe_2(SO_4)_3$, and $Fe(NO_3)_3$, then

A. the amount of iron deposited in $FeSO_4$ and $Fe_2(SO_4)_2$ are equal.

B. the amount of iron deposited in $FeSO_4$ is 1.5 times of the amount of iron deposited in $Fe(NO_3)_3$.

C. the amount of iron deposited in $Fe_2(SO_4)_3$ and $Fe(NO_3)_3$ are equal.

D. the same amount of gas is evolved in all threee cases at the anode.

Answer: B::C::D

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14. Which of the following statement(s) is/are correct?

A. The conductance of one cm^3 (or 1 unit.^{3}) of a solution is called conductivity.

B. Specific conductance increases while molar conductivity decreases on progressive dilution.

C. The limiting equivalent conductivity of weak electrolyte cannot be determined exactly by extraplation of the plot of A_{eq} against $\sqrt{c}$.

D. The conductance of metals is due to the movement of free electrons.

Answer: A::C::D

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15. The reaction

$$\frac{1}{2}H_2(g) + AgCl(s) \Leftrightarrow H^+(aq) + Cl^-(aq) + Ag(s)$$

occurs in the galvanic cell

A. $Ag|AgCl(s)|KCl\left(sol^{\cap}\right)|AgNO_3|AgNO_3\left(sol^{\cap}\right) \mid Ag$

B. $Pt|H_2(g)|HCl\left(sol^{\cap}\right)|AgNO_3\left(sol^{\cap}\right)|Ag$

C. $Pt|H_2(g)|HCl\left(sol^{\cap}\right)|AgCl(s)|Ag$

D. $Pt|H_2(g)|KCl\left(sol^{\cap}\right)|AgCl(s)|Ag$

Answer: C::D

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16. Choose the correct satement(s).

A. At the anode, the species having minimum reduction potential is formed from the oxidation of corresponding oxidizable species.

B. In highly alkaline medium, the anodic process during the electrolysis process is:

$4OH^{-} \rightarrow O_2 + 2H_2O + 4e^{-}$

C. The standard potential of $Cl^{-}|AgCl|Ag$ half cell is related to that of $Ag^{+}|Ag$ through the expression

$E^{\circ}_{Ag^{+}|Ag} = E^{\circ}_{Cl^{-}|AgCl|Ag} = +0.059$ in $[K_{sp}(AgCl)]$ at $25^{\circ}C$

D. Compounds of active metals (Zn, Na, Mg) are reducible by H_2 whereas those of noble metals (Cu, Ag, Au) are not reducible.

Answer: A::B

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17. $M(s) \rightarrow M^{n+}(aq) + \neq^{-}$

Choose the correct statement(s).

A. $E^{\circ}_{M \mid M^{n+}}$ decreases on increasing in $\left[M^{n+}\right]$

B. $E^{\circ}_{M^{m+} \mid M}$ increases on increasing temperature

C. $E^{\circ}_{M^{n+} \mid M}$ increases on increasing $\left[M^{n+}\right]$

D. $E^{\circ}_{M \mid M^{n+}}$ increases on increasing temperature

Answer: A::B::C

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18. During the working of a galvanic cell and with the passage of time.

A. spontaneity of the cell reaction decreases: E_{cell} decreaes.

B. reaction quotent Q decreases: E_{cell} increases

C. reaction quotient Q increases , E_{cell} decreases

D. at equilibrium Q=K_c : $E_{\text{cell}} = 0$

Answer: A::C::D

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19. Given that $E^{\cdot}_{Fe^{2+}/Fe} = -0.44V, E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.77V$ if Fe^{2+}, Fe^{3+} and Fe solid are kept together then

A. Fe^{3+} increases

B. Fe^{3+} decreases

C. Fe^{2+} increases

D. Fe^{2+} decreases

Answer: B::C

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20. In which of the following cell(s): $E_{\text{cell}} = E^{\circ}_{\text{cell}}$?

A. $Cu(s)\left|Cu^{2+}(0.01M)\right|\left|Ag^{+}(0.1M)\right|Ag(s)$

B. $Pt(H_2)|pH = 1|\left|Zn^{2+}(0.01M)\right| \mid Zn(s)$

C. $Pt(H_2)|pH = 1|\left|Zn^{2+}(1M)\right| \mid Zn(s)$

D. $Pt(H_2)\left|H^{+} = 0.1M\right|\left|Zn^{2+}(0.01)\right| \mid \ \mid Zn(s)$

Answer: A::B::D

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21. Which is/are correct among the following? Given the half cell EMFs

$E^{\circ}_{Cu^{2+}\,/\,Cu} = 0.337V, E^{\circ}_{Cu^{+}\,|\,Cu} = 0.521V$

A. Cu^{+} disproportionates

B. Cu and Cu^{2+} comproportinates

C. $E^{\circ}_{Cu \mid Cu^{2+}} + E^{\circ}_{Cu^{+1} \mid Cu}$ is positive

D. $E^{\circ}_{Cu^{2+} \mid Cu} = -0.153V$

Answer: A::C

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22. How long must a current of 4.00 A be applied to a solution of $Cu^{2+}(aq)$ to produce 2.0 grams of copper metal?

A. Solution in cathodic compartment is acidic.

B. Solution in anodic compartment is acidic.

C. Cell potential will be zero at $pH = \frac{2}{9}$, if activity of other components are equal to one.

D. 0.6 "mole"s of electron pass through the circuit when 0.6 "mole"s of Hg^{2+} are produced in the cell.

Answer: A::C::D

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23. For the cell

$Cu|CuSO_4||HCl|H_2 \mid Pt$ EMF can be increased by:

A. by adding NH_3 in anodic half cell

B. increasing partial pressure of H_2 gas

C. by diluting $CuSO_4$ solution

D. by diluting HCl solution.

Answer: A::C

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24. $E^{\circ}_{A^+|A} = 0.5, E^{\circ}_{B^+|B} = 0.2V,$

$E^{\circ}_{C^+|C} = -0.3V, E^{\circ}_{D^+|D} = -0.1V$ Based on above data select correct statemetns under standard condition.

A. Best oxidising agent is A^{+}

B. Best reducing agent is D

C. C can displace D from it's solution

D. In galvanic cell obtained by electrodes A and B current flows from B to A in external circuit.

Answer: A::C

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25. $E^{\circ}_{\text{cell}} = 1.1V$ for Daniel cell. Which of the following expressions are correct description of state of equilibrium in this cell?

A. 1.1=K_c

B. $\dfrac{2.303RT}{2F}\log K_c = 1.1$

C. $\log K_c = \dfrac{2.2}{0.059}$

D. $\log K_c = 1.1$

Answer: B::C

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26. Conductivity of an electrolytic solution depends on:

A. nature of electrolyte

B. concentration of electrlyte

C. power of AC source

D. distance between the electrodes

Answer: D::B

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27. $A_m^\circ H_2O$ is equal to:

A. $A^\circ_{m(HCl)} + A^\circ_{m(NaOH)} - A^\circ_{m(NaCl)}$

B. $A^{\circ}_{m(HNO_3)} + A^{\circ}_{m(NaNO_3)} - A^{\circ}_{m(NaOH)}$

C. $A^{\circ}_{(HNO_3)} + A^{\circ}_{m(NaOH)} - A^{\circ}_{m(NaNO_3)}$

D. $A^{\circ}_{m(NH_4OH)} + A^{\circ}_{m(HCl)} - A^{\circ}_{m(NH_4Cl)}$

Answer: A::C::D

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28. Which of the following are correct for a galvanic cell (Q=Reaction quotient)?

A. If $Q < 1$ then $E_{\text{cell}} > E^{\circ}_{\text{cell}}$

B. If Q=1 then $E_{\text{cell}} < E^{\circ}_{\text{cell}}$

C. If Q=1 the $E_{\text{cell}} = E^{\circ}_{\text{cell}}$

D. If $Q > 1$ then $E_{\text{cell}} < E^{\circ}_{\text{cell}}$

Answer: A::C::D

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29. Which of the following are correct in acidic medium?

A. The oxidising power of $KMnO_4$ will increase with increase in pH

B. The oxidising power of $KMnO_4$ will decrease with increase in pH

C. The oxidising of $K_2Cr_2O^7$ will increase with increase in pH

D. The oxidising power of $K_2Cr_2O^7$ will decrease with increase in pH

Answer: B::D

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30. Which of the following statement(s) is/are correct?

A. The equilibrium constant of cell reaction in a concentration cell is 1

B. Activity of a radioactive nucleus is temperature independent.

C. Limiting molar conductivities $\left(A_{\bar{m}}\right)$ of NaCl and KCl are different due to difference in ionic mobilities of Na^+ (aq) and K^+ (aq) ions.

D. When aq. Solution of 2Mj-HCl is electrolysed, more H^+ ions are reduced at cathode than Cl^- ions at anode due to higher ionic mobility of H^+ (aq) ions.

Answer: A::B::C

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31. Choose the correct statement(s)

A. Cell constant values of conductivity cells are independent of the solution filled into the cell.

B. Kohlrausch law is valid for strong eletrolyte but not for weak electrolyte.

C. In general conductivity decreases on dilution whereas equivalent and molar conductivity increase on dilution.

D. Salt bridge is employed to maintain the electrical neutrality and to minimize the liquid -liquid junction potential.

Answer: A::C::D

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32. For the cell $Tl|Tl^{+}(0.001M)||Cu^{2+}(0.01M)|Cu.\ E_{\text{cell}}$ at $25^{\circ}C$ is 0.83V, which can be increased:

A. by increasing $[Cu^{2+}]$

B. by increasing $[Tl^{+}]$

C. by decreasing $[Cu^{2+}]$

D. by decreasing $[Tl^{+}]$

Answer: A::D

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33. For the reduction of NO_3^- ion in an aqueous solution E° is $+0.96V$.

Value of E° for some metal ions are given below

$V^{2+}(aq) + 2e^- \rightarrow V E^\circ = -1.19V$

$Fe^{3+}(aq) + 3e^- \rightarrow Fe E^\circ = -0.04V$

$Au^{3+}(aq) + 3e^- \rightarrow Au E^\circ = +1.40V$

$Hg^{2+}(aq) + 2e^- \rightarrow Hg E^\circ = +0.86V$

The pair(s) of metal that is/are oxidised by NO_3^- in aqueous solution is(arE):

A. V and Hg

B. Hg and Fe

C. Fe and Au

D. Fe and V

Answer: A::B::D

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Comprehension type

1. Standard reduction potentials (SRP) for different systems can be used to decide the spontaneity of a reaction e.g., $E^\circ_{2n^{2+}\,/\,Zn} = -0.76V$, hence for the reaction $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$, ΔG° is negative. It has been found experimentally that if (SRP of an oxidant-SRP of a reductant) is more than 1.7V, then their combination may lead to explosion (though it may be prevented by kinetic factors).

Now go through the following data and answer the questions.

Data:

$E^\circ_{Ag^+|Ag} = 0.80\ V$;

$E^\circ_{ClO_4^-|ClO_3^-} = 1.23\ V$;

$E^\circ_{Fe^{3+}|Fe^{2+}} = 0.77\ V$;

$E^\circ_{H_2O_2|H_2O} = 1.76\ V$;

$E^\circ_{MnO_4^-|Mn^{2+}} = 1.54\ V$;

$E^\circ_{N_2|N_3^-} = -3.09\ V$

$E^\circ_{Na^+|Na} = -2.71\ V$

$E^\circ_{O_2|H_2O_2} = -1.03\ V$

$E^\circ_{O_3|O_2} = 2.07\ V$

$E^\circ_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33\ V$

Which of the following ionic combinations may lead to the formation of explosive substance?

A. Sodium ion and azide ion

B. Silver ion and perchlorate ion

C. Silver ion and azide ion

D. All of the above

Answer: C

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2. Standard reduction potentials (SRP) for different systems can be used to decide the spontaneity of a reaction e.g., $E^{\circ}_{2n^{2+}\,/\,Zn} = -0.76V$, hence for the reaction $Zn + 2H^{+} \rightarrow Zn^{2+} + H_2, \Delta G^{\circ}$ is negative. It has been found experimentally that if (SRP of an oxidant-SRP of a reductant) is more than 1.7V, then their combination may lead to explosion (though it may be prevented by kinetic factors).

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Data:

$E^{\circ}_{Ag^{+}\mid Ag} = 0.80\ V$;	$E^{\circ}_{N_2\mid N_3^{-}} = -3.09\ V$
$E^{\circ}_{ClO_4^{-}\mid ClO_3^{-}} = 1.23\ V$;	$E^{\circ}_{Na^{+}\mid Na} = -2.71\ V$
$E^{\circ}_{Fe^{3+}\mid Fe^{2+}} = 0.77\ V$;	$E^{\circ}_{O_2\mid H_2O_2} = -1.03\ V$
$E^{\circ}_{H_2O_2\mid H_2O} = 1.76\ V$;	$E^{\circ}_{O_3\mid O_2} = 2.07\ V$
$E^{\circ}_{MnO_4^{-}\mid Mn^{2+}} = 1.54\ V$;	$E^{\circ}_{Cr_2O_7^{2-}\mid Cr^{3+}} = 1.33\ V$

Which of the following ion will be capable of causing catalytic decomposition of H_2O_2?

A. Fe^{3+} increases

B. Fe^{3+} will be reduced to Fe(2+)

C. Both a and b

D. none of these

Answer: C

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3. Standard reduction potentials (SRP) for different systems can be used to decide the spontaneity of a reaction e.g., $E^{\circ}_{2n^{2+}/Zn} = -0.76V$, hence for the reaction $Zn + 2H^{+} \rightarrow Zn^{2+} + H_2, \Delta G^{\circ}$ is negative. It has been found experimentally that if (SRP of an oxidant-SRP of a reductant) is more than 1.7V, then their combination may lead to explosion (though it may be prevented by kinetic factors).

Now go through the following data and answer the questions.

Data:

$E^\circ_{Ag^+|Ag} = 0.80\ V$; $E^\circ_{N_2|N_3^-} = -3.09\ V$

$E^\circ_{ClO_4^-|ClO_3^-} = 1.23\ V$; $E^\circ_{Na^+|Na} = -2.71\ V$

$E^\circ_{Fe^{3+}|Fe^{2+}} = 0.77\ V$; $E^\circ_{O_2|H_2O_2} = -1.03\ V$

$E^\circ_{H_2O_2|H_2O} = 1.76\ V$; $E^\circ_{O_3|O_2} = 2.07\ V$

$E^\circ_{MnO_4^-|Mn^{2+}} = 1.54\ V$; $E^\circ_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33\ V$

Which statement about standard reduction potentials in correct?

A. $E^\circ_{H^+/H_2} =$ zero at all temperature

B. $E^\circ_{D^+/D_2} =$ Zero at 298 K

C. A redox reaction is feasible if sum of SRP of oxidant and that of reductant is a negative quantity.

D. $K_2Cr_2O^7$ (acid) is stronger oxidising agent than $KMnO_4$ (acid).

Answer: A

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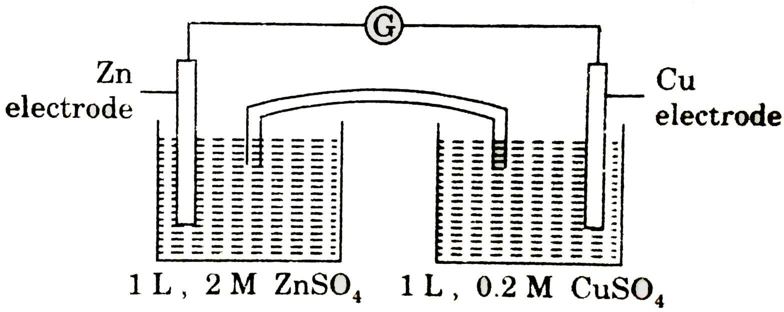
4.



[Given:

$$E^{\circ}_{Zn^{2+}\,|\,Zn} = -.0.76V\,K_f\left[Cu(NH_3)_4\right]^{+2} = 4\times10^{11}$$

$$E^{\circ}_{Cu^{2+}\,|\,Cu} = 0.34V$$

The emf of cell at 200K is: [Given: $\dfrac{2.303\times R}{F} = 2\times10^{-4}$ and assume that E° values are independent of temperature.]

A. 1.7V

B. 1.08V

C. 1.09V

D. 1.10V

Answer: B

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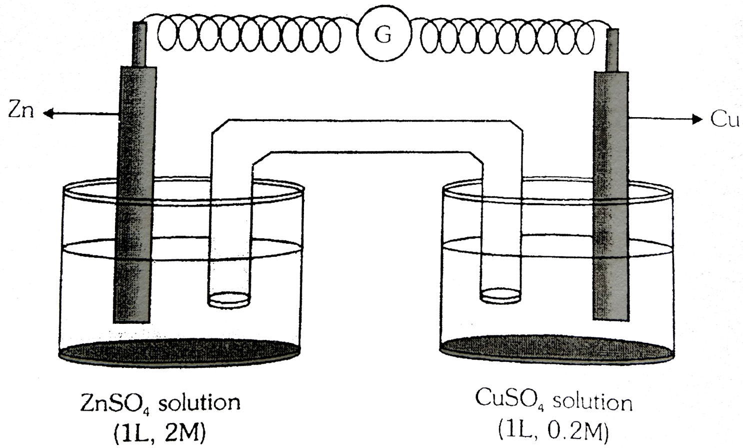
5.



Given:

$$E^\circ_{Zn^{+2}/Zn} = -0.76V$$

$$E^\circ_{Cu^{+2}/Cu} = +0.34V$$

$$K_f\left[Cu(NH_3)_4\right]^{2+} = 4 \times 10^{11}$$

$$\frac{2.303R}{F} = 2 \times 10^{-4}$$

At what concentration of Cu^{+2} emf of the cell will be zero (at 298K) and concentration of Zn^{+2} is remains same:

A. 0.81V

B. 1.91V

C. 1.1V

D. 0.72V

Answer: A

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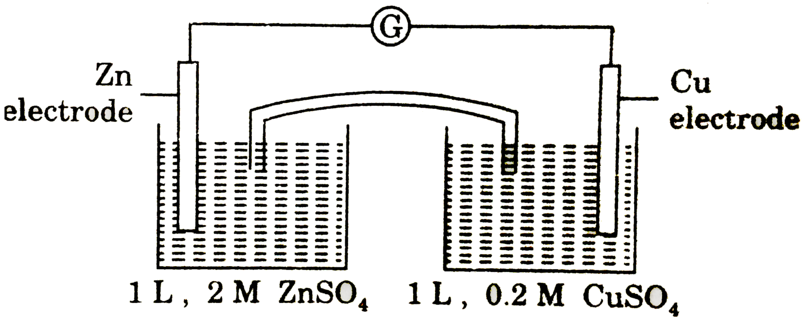
6.



[Given:

$E^{\circ}_{Zn^{2+}|Zn} = -.0.76V K_f\left[Cu(NH_3)_4\right]^{+2} = 4 \times 10^{11}$

$E^{\circ}_{Cu^{2+}|Cu} = 0.34V$

At what conc. Of Cu^{+2}, emf of the cell will be zero (at 298K) at conc. Of Zn^{+2} is remaining same?

A. 1.03×10^{-37}

B. 1.03×10^{-20}

C. 3.78×10^{-4}

D. 0.0068

Answer: A

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7. The molar conductance of NaCl varies with the concentration as shown in the following table and all values follows the equation.

$\lambda_m^c = \lambda_m^\infty - b\sqrt{C}$ where λ_m^c= molar specific conductance λ_m^∞ = molar specific conductance at infinite dilution C=molar concentration

Molar Concentration of NaCl	Molar Conductivity in $ohm^{-1}\ cm^2\ mole^{-1}$
4×10^{-4}	107
9×10^{-4}	97
16×10^{-4}	87

When a certain conductivity cell (C) was filled with 25 $\times 10^{-4}(M) NaCl$ solution, the resistance of the cell was found to be 1000 ohm. At infinite dilution, conductance of Cl^- and SO_4^{2-} are $80 ohm^{-1} cm^2 \text{mole}^{-1}$ and $160 ohm^{-1} cm^2 \text{mole}^{-1}$ respectively.

What is the molar conductance of NaCl at infinite dilution?

A. $147 ohm^{-1} cm^2 mo \le^{-1}$

B. $107 ohm^{-1} cm^2 \text{mole}^{-1}$

C. $127 ohm^{-1} cm^2 \text{mole}^{-1}$

D. $157 ohm^{-1} cm^2 \text{mole}^{-1}$

Answer: C

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8. The molar conductance of NaCl varies with the concentration as shown in the following table and all values follows the equation.

$\lambda_m^c = \lambda_m^\infty - b\sqrt{C}$ where λ_m^c= molar specific conductance $\lambda_m^\infty =$ molar specific conductance at infinite dilution C=molar concentration

Molar Concentration of NaCl	Molar Conductivity in $ohm^{-1} cm^2 mole^{-1}$
4×10^{-4}	107
9×10^{-4}	97
16×10^{-4}	87

When a certain conductivity cell (C) was filled with $25 \times 10^{-4} (M) NaCl$ solution, the resistance of the cell was found to be 1000 ohm. At infinite dilution, conductance of Cl^- and SO_4^{2-} are $80 ohm^{-1} cm^2 \text{mole}^{-1}$ and

$160 ohm^{-1} cm^2 \text{mole}^{-1}$ respectively.

What is the cell constant of the conductivity cell (C)?

A. $0.385 cm^{-1}$

B. $3.85 cm^{-1}$

C. $38.5 cm^{-1}$

D. $0.1925 cm^{-1}$

Answer: D

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9. The molar conductance of NaCl vauies with the concentration as shown in the following table. And all values follows the equation $\lambda_m^C = \lambda_m^\infty - b\sqrt{C}$ Where λ_m^C= molar specific conductance λ_m^∞=molar specific conductance at infinite dilution C = molar concentration

Molar concentration	Molar conductance of NaCl in $\text{ohm}^{-1}\text{cm}^2\text{mole}^{-1}$
4×10^{-4}	107
9×10^{-4}	97
16×10^{-4}	87

When a certain conductivity cell (C) was filled with $25 \times 10^{-4}(M)$ NaCl solution. The resistance of the cell was found to be 1000 ohm. At Infinite dilution, conductance of CI^{-} and SO_4^{-2} are 80 $ohm^{-1}cm^2\text{mole}^{-1}$ and 160 $ohm^{-1}cm^2\text{mole}^{-1}$ respectively.

It the cell (C) is filled with $5 \times 10^{-3}(N)Na_2SO_4$ the obserbed resistance was 400 ohm. What is the molar conductance of Na_2SO_4.

A. $19.25ohm^{-!}cm^2\text{mole}^{-1}$

B. $96.25ohm^{-1}cm^2\text{mole}^{-1}$

C. $385ohm^{-1}cm^2\text{mole}^{-1}$

D. $192.5ohm^{-1}cm^2\text{mole}^{-1}$

Answer: D

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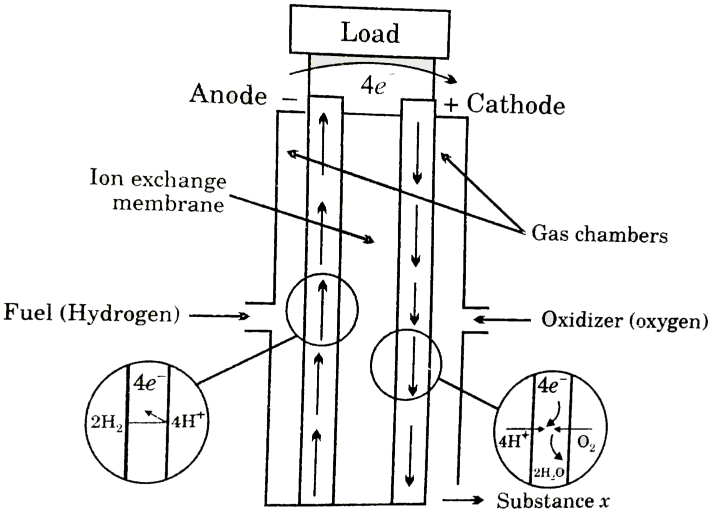
10. A fuel cell is a cell that is continuously supplied with an oxidant and a reductant so that it can deliver a current indefinitely. Fuel cell offer the possibility of achieving high thermodynamic efficiency in the conversion of Gibbs energy into mechanical work. Internal combustion engines at best convert only the fraction $(T_2 - T_1)T_2$ of heat of combustion into mechanical work. While the thermodynamic efficiency of the fuel cell is give by, $\eta = \frac{|\Delta G|}{|\Delta H|}$, where ΔG is the Gibbs energy change for the cell reaction and ΔH is the enthalpy change of the cell reaction. This efficiency can be upto 80%-90% also in contrast to normal heat engine efficiency which are generally about 40%



Hydrogen-oxygen fuel cell

Fuel cells may be classified according to the temperature range in wich they operate low temperature (25 to $100^\circ C$), medium temperature (100 to $500^\circ C$)), high temperature ($500 \text{to} 1000^\circ C$) and very high temperature is that catalyst for the various steps in the process are not so necessary. Polarization of a fuel cell reduces the current. Polarization is the result of slow reactions or processes such as diffusion in the cell. The figure indicates the construction of hydrogen-oxygen fuel cell with a solid electrolyte, which is an ion exchange membrane. The membrane is impermeable to the reactant gases, but is permeable to hydrogen ions, which carry the current between the electrodes. To facillitate the operation finely divided platinum that function as a catalyst. Water is drained out of the cell during operation. Fuel cells of this general type have been used successfully in the space program and are quite efficient. their disadvantages for large-scale commercial application are that hydrogen presetns storage problems, and platinum is an expensive catalyst. Cheaper catalysts have been found for higher temperature operatureof hydrogen-oxygen fuel cells. Fuel cells taht use hydrocarbons and air have been developed, but their power per unit weight is too low to make them practical in ordinary automobiles. Better catalysts are needed. A hydrogen-oxygen fuel cell may hae an acidic or alkaline electrolyte. The half-cell reactions are:

$$\frac{1}{2}O_2(g) + 2H^+ + 2e^- \rightarrow H_2O(l)E^\circ = 1.2288V$$

$$2H^+ + 2e^- \rightarrow H_2(g)E^\circ = 0$$

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)E^\circ = 1.2288V$$

or $\frac{1}{2}O_2(g)+H_2O(g)+2e^- \rightarrow 2OH^- E^\circ = 0.4009V$

$2H_2O(l)+2e^- \rightarrow H_2(g)+2OH^- E^\circ = -0.8279V$

$H_2(g)+\frac{1}{2}O_2(g) \rightarrow H_2O(l) E^\circ = 1.2288V$

To maximize the power per unit mass of an electrochemical cell, the electronic and electrolytic resistances of the cell must be minimized. than aqueous solutions, high-temperature electrochemical cells are of special interest for practical applications. High temperature also allow the use of liquid metal electrode, which makes possibel high current densities than solid electrodes.

If 567.5 mL of H_2 gas at STP is fed into and is consumed by the cell in 10minutes, then what is the current output (in A) of the fuel cell?

A. 4A

B. 8A

C. 16A

D. 12A

Answer: B

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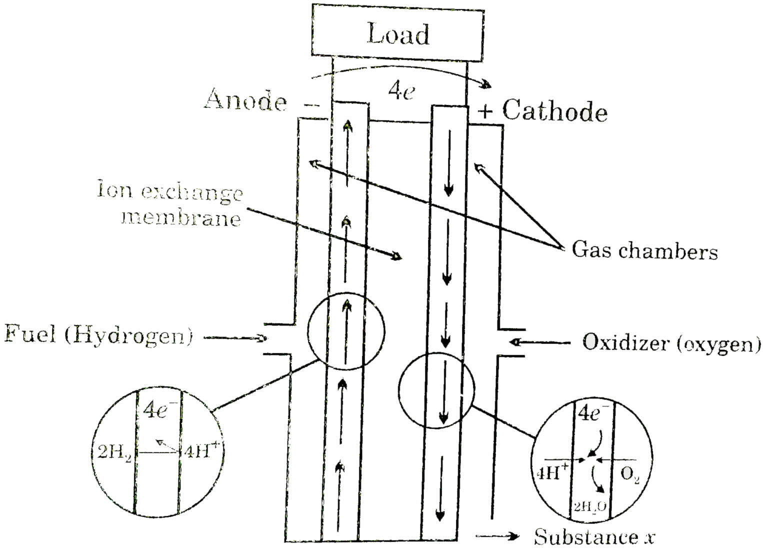
11. A fuel cell is a cell that is continuously supplied with an oxidant and a reductant so that it can deliver a current indefinitely. Fuel cell offer the possibility of achieving high thermodynamic efficiency in the conversion of Gibbs energy into mechanical work. Internal combustion engines at best convert only the fraction $(T_2 - T_1)T_2$ of heat of combustion into mechanical work. While the thermodynamic efficiency of the fuel cell is give by, $\eta = \dfrac{|\Delta G|}{|\Delta H|}$, where ΔG is the Gibbs energy change for the cell reaction and ΔH is the enthalpy change of the cell reaction. This efficiency can be upto 80%-90% also in contrast to normal heat engine efficiency which are generally about 40%



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To maximize the power per unit mass of an electrochemical cell, the electronic and electrolytic resistances of the cell must be minimized. than aqueous solutions, high-temperature electrochemical cells are of special interest for practical applications. High temperature also allow the use of liquid metal electrode, which makes possibel high current densities than solid electrodes.

For a hydrogen-oxygen fuel cell if $\Delta H_f^2(H_2O, l) = -285kJ/mo \leq$, then what will be its thermodynamic efficiency under standard conditions (use data given in the passage if required)?

A. 0.91

B. 0.41

C. 0.63

D. 0.83

Answer: D

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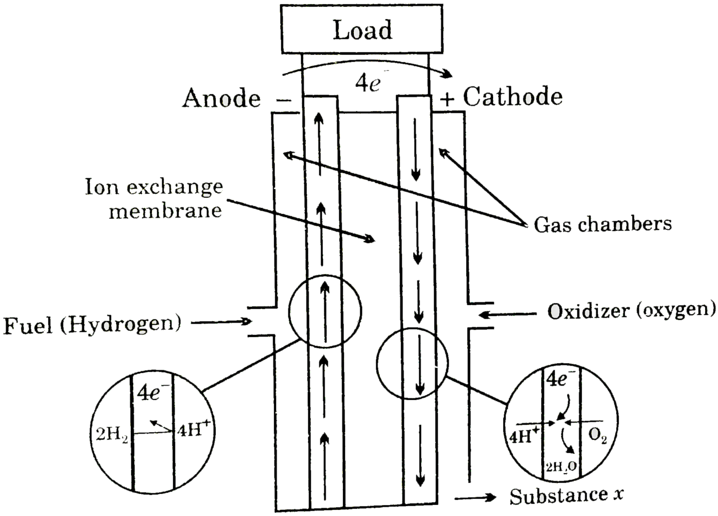

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Why are fuel cells not being used in daily life depite their very high efficiency?

A. The fuels needed for their operation are rarely found in nature.

B. Their operation always needs very high temperature and do not work at low temperature.

C. The catalyst used in fuel cells at normal temperature are very expensive

D. The design of fuel cells is so complicated that it is not feasible to construct these for daily life applications.

Answer: C

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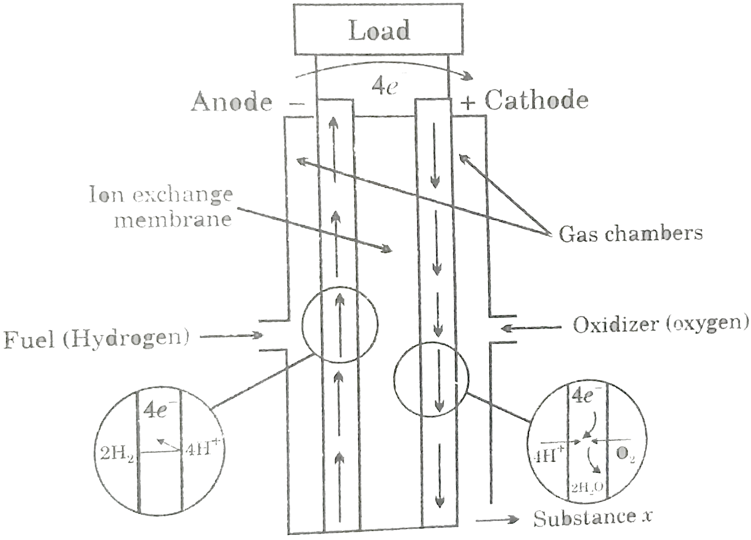

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What is the substance X taken out at bottom of the fuel cell shown in the figure?

A. H_2O

B. H_2O_2

C. Both a and b

D. Neither

Answer: A

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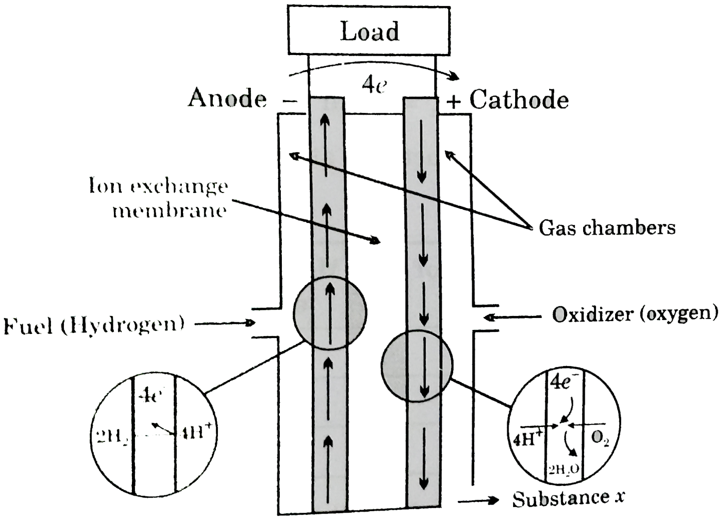

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The advantage of using fuel cell in a motorcar could be:

A. non emission of harmful gases

B. light weight

C. freedom from refueling

D. low initial cost

Answer: A

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15. Tollen reagent is used for the detection of aldehydes. When a solution of $AgNO_3$ is added to glucose with NH_4OH, then gluconic acid is formed.

$$Ag^{\oplus} + e^{-} \rightarrow Ag, \qquad E^{c-}{}_{\cdot red} = 0.8V$$

$$C_6H_{12}O_6 \rightarrow \underset{Gluconicacid}{C_6H_{12}O_7} + 2H^{\oplus} + 2e^{-}, \qquad E^{c-}{}_{\cdot oxid} = -0.05V$$

$$\left[Ag(NH_3)_2\right]^{\oplus} + e^{-} \rightarrow Ag(s) + 2NH_3, \qquad E^{c-}{}_{\cdot red} = 0.337V$$

$$\left[Use 2.303 \times \frac{RT}{F} = 0.0592 \text{ and } \frac{F}{RT} = 38.92 at 298K\right]$$

Ammonia is always added in this reaction. Which of the followijng must be wrong ?

A. 66.13

B. 58.38

C. 28.3

D. 46.29

Answer: B

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$$\left[Use 2.303 \times \frac{RT}{F} = 0.0592 \text{ and } \frac{F}{RT} = 38.92 at 298K\right]$$

When ammonia is added to the solution, pH is raised to 11. Which half cell reaction is affected by pH and by how much ?

A. E_{oxd} will increase by a factor of 0.65 for E°_{oxd}

B. E_{oxd} will decrease by a factor of 0.65 for E°_{oxd}

C. E_{red} will increase by a factor of 0.65 for E°_{red}

D. E_{red} will decrease by a factor of 0.65 for E°_{red}

Answer: A

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17. Tollen reagent is used for the detection of aldehydes. When a solution of $AgNO_3$ is added to glucose with NH_4OH, then gluconic acid is formed.

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$$\left[Use 2.303 \times \frac{RT}{F} = 0.0592 \text{ and } \frac{F}{RT} = 38.92 at 298K\right]$$

Ammonia is always added in this reaction. Which of the followijng must be wrong ?

A. NH_3 combines with Ag^+ to form a complex.

B. $Ag(NH_3)_2^+$ is a weaker oxidising reagent than Ag^+

C. In absence of NH_3. Silver salt of gluconic acid is formed.

D. NH_3 has affected the standard reduction of glucose/gluconic acid electrode.

Answer: D

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18. A sample of water from a large swimming pool has a resistance of 10000Ω at $25^\circ C$ when placed in a certain conductace cell. When filled with $0.02 MKCI$ solution, the cell has a resistance of 100Ω at $25^\circ C$, $585 gm$ of $NaCI$ were dissolved in the pool, which was throughly stirred. A sample of this solution gave a resistance of 8000Ω.

Given: Molar conductance of $NaCI$ at that concentration is $125\Omega^{-1} cm^2 mol^{-1}$ and molar conductivity of KCI at $0.02M$ is $200W^{-1} cm^2 mol^{-1}$.

Cell constant (in cm^{-1}) of conductane cell is:

A. 4

B. 0.4

C. 4×10^{-2}

D. 4×10^{-5}

Answer: B

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Cell constant (in cm^{-1}) of conductane cell is:

A. 4×10^{-2}

B. 4×10^{-3}

C. 4×10^{-5}

D. none of these

Answer: C

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20. A sample of water from a large swimming pool has a resistance of 10000Ω at $25^\circ C$ when placed in a certain conductace cell. When filled with $0.02 M KCI$ solution, the cell has a resistance of 100Ω at $25^\circ C$, $585 gm$ of $NaCI$ were dissolved in the pool, which was throughly stirred. A sample of this solution gave a resistance of 8000Ω.

Given: Molar conductance of $NaCI$ at that concentration is $125\Omega^{-1}cm^2mol^{-1}$ and molar conductivity of KCI at $0.02M$ is $200W^{-1}cm^2mol^{-1}$.

Volume (in Litres) of water in the pool is:

A. 1.25×10^5

B. 1250

C. 12500

D. none of these

Answer: A

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21. Given below are a set of half-cell reactions (acidic medium) along with their $E_{\circ}$ with respect to normal hydrogen electrode values. Using the data obtain the correct explanation to question given below.

$$\begin{array}{ll} I_2 + 2e^- \rightarrow 2I^- & E^\circ = 0.54 \\ Cl_2 + 2e^- \rightarrow 2Cl^- & E^\circ = 1.36 \\ Mn^{2+} + e^- \rightarrow Mn^{2+} & E^\circ = 1.50 \\ Fe^{3+} + e^- \rightarrow Fe^{2+} & E^\circ = 0.77 \\ O_2 + 4H^+ + 4e^- \rightarrow 2H_2O & E^\circ = 1.23 \end{array}$$

Among the following, identify the correct statement:

A. Chloride ion is oxidised by O_2

B. Fe^{2+} is oxidised by iodine.

C. Iodide ion is oxidised by chlorine

D. `Mn^(2+) is oxidised by chlorine

Answer: C

Watch Video Solution

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$$I_2 + 2e^- \rightarrow 2I^- \qquad E^\circ = 0.54$$
$$Cl_2 + 2e^- \rightarrow 2Cl^- \qquad E^\circ = 1.36$$
$$Mn^{2+} + e^- \rightarrow Mn^{2+} \qquad E^\circ = 1.50$$
$$Fe^{3+} + e^- \rightarrow Fe^{2+} \qquad E^\circ = 0.77$$
$$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \qquad E^\circ = 1.23$$

While Fe^{2+} is stable, Mn^{3+} is not stable in acid solution because:

A. O_2 oxidises Mn^{2+} to Mn^{3+} and Fe^{2+} to Fe^{3+}

B. O_2 oxidises both Mn^{2+} to Mn^{3+} and Fe^{2+} to Fe^{3+}

C. Fe^{3+} oxidises H_2O to O_2

D. Mn^{3+} oxidises H_2O to O_2

Answer: D

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23. The concentration of potassium ions inside a biological cell is at least 20 times higher than outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simplel model for a concentration cell involving a metal M is

$M(s) \mid M^{\oplus}(aq, 0.05 \text{ molar}) \mid \mid M^{\oplus}(aq, 1 \text{ molar}) \mid M(s)$

For the abov electrolytic cell, the magnitude of the cell potential is $|E_{cell}| = 70 mV$.

If the 0.05 moolar solution of $M^{\oplus}$ is replaced by a 0.0025 molar $M^{\oplus}$ solution, then the magnitude of the cell potential would be

A. $E_{\text{cell}} < 0, \Delta G > 0$

B. $E_{\text{cell}} > 0, \Delta G < 0$

C. $E_{\text{cell}} < 0, \Delta G^{\circ} > 0$

D. $E_{\text{cell}} > 0, \Delta G^{\circ} < 0$

Answer: B

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24. The concentration of potassium ions inside a biological cell is at least 20 times higher than outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simplel model for a concentration cell involving a metal M is

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For the abov electrolytic cell, the magnitude of the cell potential is $|E_{cell}| = 70mV$.

If the 0.05 moolar solution of $M^{\oplus}$ is replaced by a 0.0025 molar $M^{\oplus}$ solution, then the magnitude of the cell potential would be

A. 35mV

B. 70mV

C. 140mV

D. 700mV

Answer: C

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25. Standard reduction potential (volts) in acid solution is given by the Latimer diagram as shown:

$$CiO_4^- \xrightarrow{1.19} CIO_3^- \xrightarrow{1.21} CIO \rightarrow Cl_2 \rightarrow Cl^-$$

What is standard reduction potential of $CIO_3^- \rightarrow \frac{1}{2}Cl_2$ In acidic medium is:

A. 1.47V

B. 4.47V

C. 2.23V

D. 0.894V

Answer: A

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26. Standard reduction potential (volts) in acid solution is given by the Latimer diagram as shown:

$$CiO_4^- \xrightarrow{1.19} ClO_3^- \xrightarrow{1.21} ClO \rightarrow Cl_2 \rightarrow Cl^-$$

Which of the following cannot disproportionate in acid solution under standard conditions?

A. ClO_3^-

B. ClO_2^-

C. Cl_2

D. ClO^-

Answer: C

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27. Standard reduction potential (volts) in acid solution is given by the Latimer diagram as shown:

$$CiO_4^- \xrightarrow{1.19} ClO_3^- \xrightarrow{1.21} ClO \rightarrow Cl_2 \rightarrow Cl^-$$

The pH at which $E_{ClO_3^- | ClO^-} = 1.31$ volt is: [Given: $[ClO_3^- = 1M, [ClO^-] = 1M, \frac{2.303RT}{F} = 0.06]$

A. 0

B. 1

C. 2

D. 12

Answer: C

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28. The overall reaction electrochemical cell at 298K.

$$Ag(s)|AgI(s)|I^-(aq)||Cl^-(aq)|Hg_2Cl_2|Hg(l) \mid Pt(s)$$

[Given: $E^\circ_{Cl^- | Hg_2Cl_2 | Hg} = 0.26V$. $E^\circ_{Ag^+ | Ag} = 0.8V$.

$K_{sp}(Agl) = 10^{-16}$ and $\frac{2.303RT}{F} = 0.06]$

The overall reaction occuring in the above cell is:

A. $\frac{1}{2}Hg_2Cl_2(s) + Ag(s) + I^-(aq) \rightarrow Hg(l) + Cl^-(aq) + Agl(s)$

B. $Ag^+(aq) + I^-(aq) \rightarrow Agl(s)$

C. $Hg_2^{2+}(aq) + I2Cl^-(aq) \rightarrow Hg_2Cl_2(s)$

D. $Hg_2Cl_2(s) + 2Agl(s) \rightarrow 2AgCl(s) + Hg_2I_2(s)$

Answer: A

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29. The overall reaction electrochemical cell at 298K.

$Ag(s)|AgI(s)|I^-(aq)||Cl^-(aq)|Hg_2Cl_2|Hg(l) \mid Pt(s)$

[Given: $E^\circ_{Cl^-\,|\,Hg_2Cl_2\,|\,Hg} = 0.26V.\ E^\circ_{Ag^+\,|\,Ag} = 0.8V.$

$K_{sp}(Agl) = 10^{-16}$ and $\frac{2.303RT}{F} = 0.06$]

E°_{cell} of the above cell is:

A. 0.42 volt

B. 0.44 volt

C. 0.10volt

D. $-0.06V$

Answer: A

Watch Video Solution

30. The overall reaction electrochemical cell at 298K.

$Ag(s)|AgI(s)|I^{-}(aq)||Cl^{-}(aq)|Hg_2Cl_2|Hg(l) \mid Pt(s)$

[Given: $E^{\circ}_{Cl^{-}\,|\,Hg_2Cl_2\,|\,Hg} = 0.26V.\ E^{\circ}_{Ag^{+}\,|\,Ag} = 0.8V.$

$K_{sp}(Agl) = 10^{-16}$ and $\dfrac{2.303RT}{F} = 0.06]$

At equilibrium ratio of $\dfrac{[Cl^{-}]}{[I^{-}]}$ in the above cell will be:

A. 10^{7}

B. 200

C. 10^{-7}

D. none of these

Answer: A

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31. To find the K_{sp} of $AgBrO_3$, a student prepared one litre of a saturated solution by adding only sufficient $AgBrO_3$ in water at $27^{\circ} C$. He found that a copper wire left in the solution overnight become covered with silver and Cu^{2+} ion were also formed in the solution. The wire was dried and found to weigh 15.25 mg more that its original weight.

$Cu(s) + 2Ag^{+}(aq) \Leftrightarrow Cu^{2+}(aq) + 2Ag(s)$,

$\Delta G^{\circ} = -110.4kJ$

[Given: $R = 8J/K - \text{mol}, Cu = 63.5, Ag = 108$]

The number of "mole"s of Cu reacted was:

A. 1.0×10^{-4}

B. 1.0

C. 0.10

D. 1.0×10^{-3}

Answer: A

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32. To find the K_{sp} of $AgBrO_3$, a student prepared one litre of a saturated solution by adding only sufficient $AgBrO_3$ in water at $27^{\circ}C$. He found that a copper wire left in the solution overnight become covered with silver and Cu^{2+} ion were also formed in the solution. The wire was dried and found to weigh 15.25 mg more that its original weight.

$Cu(s) + 2Ag^{+}(aq) \Leftrightarrow Cu^{2+}(aq) + 2Ag(s)$,

$\Delta G^{\circ} = -110.4kJ$

[Given: $R = 8J/K - \text{mol}, Cu = 63.5, Ag = 108$]

The concentration of Ag^{+} in the original saturated solution was:

A. 1.0×10^{-2}

B. 1.0×10^{-4}

C. 2.0×10^{-4}

D. 5.0×10^{-5}

Answer: C

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33. To find the K_{sp} of $AgBrO_3$, a student prepared one litre of a saturated solution by adding only sufficient $AgBrO_3$ in water at $27^{\circ}C$. He found that a copper wire left in the solution overnight become covered with silver and Cu^{2+} ion were also formed in the solution. The wire was dried and found to weigh 15.25 mg more that its original weight.

$Cu(s) + 2Ag^{+}(aq) \Leftrightarrow Cu^{2+}(aq) + 2Ag(s)$,

$\Delta G^{\circ} = -110.4 kJ$

[Given: $R = 8J/K - \text{mol}, Cu = 63.5, Ag = 108$]

The K_{sp} for $AgBrO_3$ is:

A. 1.0×10^{-46}

B. 1.0×10^{46}

C. 2.0×10^{-4}

D. 4.0×10^{-8}

Answer: D

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34. A fully charged lead-storage battery contains 1.5L of 5M H_2SO_4. During discharging of lead-storage acid battery, following reaction takes place:

$Pb(s) + PbO_2(s) + 2H_2SO_4 \rightarrow 2PbSO_4(s) + 2H_2O$

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35. A fully charged lead-storage battery contains 1.5L of 5M H_2SO_4. During discharging of lead-storage acid battery, following reaction takes place:

$Pb(s) + PbO_2(s) + 2H_2SO_4 \rightarrow 2PbSO_4(s) + 2H_2O$

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36. 100L aqueous solution of KBr is electrlysed by using current of 9.65 ampere for 10 seconds, using Pt electrode.

Which of the following species will not be produced due to electrolysis?

A. H_2

B. O_2

C. Br_2

D. KOH

Answer: B

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37. 100L aqueous solution of KBr is electrlysed by using current of 9.65 ampere for 10 seconds, using Pt electrode.

pH of the the resulting solution in cell will be:

A. 3

B. 5

C. 11

D. 9

Answer: D

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38. Redox reactions play a pivotal role in chemistry and biology. The values of standard redox potential (E°) of two half-cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited.

For the cell: Pt $|H_2(0.4\text{atm})H^+(pH = 1)||H^+(pH = 2)|H_2(0.1\text{atm})|$ Pt, the measured potential at $25^{\circ}C$ is:

[Given: 2.303RT/F=0.06V, log 2=0.3]

A. $-0.1V$

B. $-0.5V$

C. $-0.042V$

D. $-0.035V$

Answer: C

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39. Redox reactions play a pivotal role in chemistry and biology. The values of standard redox potential (E°) of two half-cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited.

$E^{\circ}(SRP)$ of different half cells are given below:

$E^{\circ}_{Cu^{2+}\,|\,Cu} = 0.34V, E^{\circ}_{Zn^{2+}\,|\,Zn} = -0.76V$

$E_{Ag^{+}\,|\,Ag = 0.8V}, E_{Mg^{2+}\,|\,Mg} = -2.37V$ In which cell, ΔG° per "mole" of electron is most negative?

A. $Zn(s)|Zn^{2+}(1M)||Mg^{2+}(1M)|Mg(s)$

B. $Zn(s)|Zn^{2+}(1M)||Ag^{+}(1M)|Ag(s)$

C. $Cu(s)|Cu^{2+}(1M)||Ag^{+}(1M)|Ag(s)$

D. $Ag(s)|Ag^{+}(1M)||Mg^{2+}(1M)|Mg(s)$

Answer: B

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40. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V E_{Cr^{3+}|Cr} = -0.74V$

Mark the strongest reducing agent.

A. Cl^-

B. Cr

C. Cr^{3+}

D. Mn^{2+}

Answer: D

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41. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V E_{Cr^{3+}|Cr} = -0.74V$

Mark the strongest oxidising agent.

A. Cl^{-}

B. Mn^{2+}

C. MnO_4^{-}

D. Cr^{3+}

Answer: C

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42. Using the data given below:

$$E^{\circ}_{Cr_2O_7^{2-} | Cr^{3+}} = 1.33V \, E^{\circ}_{Cl_2 | Cl^{-}} = 1.36V$$

$$E^{\circ}_{MnO_4^{-} | Mn^{2+}} = 1.51V \, E_{Cr^{3+} | Cr} = -0.74V$$

In which option the order of reducing power is correct?

A. $Cr^{3+} < Cl^{-} < Mn^{2+} < Cr$

B. $Mn^{2+} < Cl^{-} < Cr^{3+} < Cr$

C. $Cr^{+3} < Cl^{-} < Cr_2O_7^{2-} < MnO_4^{-}$

D. $Mn^{2+} < Cr^{3+} < Cl^{-} < Cr$

Answer: B

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43. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-} | Cr^{3+}} = 1.33V E^{\circ}_{Cl_2 | Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^- | Mn^{2+}} = 1.51V E_{Cr^{3+} | Cr} = -0.74V$

Find the most stable ion in its reduced forms

A. Cl^-

B. Cr^{3+}

C. Cr

D. Mn^{2+}

Answer: D

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44. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-} | Cr^{3+}} = 1.33V E^{\circ}_{Cl_2 | Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^- | Mn^{2+}} = 1.51V E_{Cr^{3+} | Cr} = -0.74V$

Find the most stable oxidised species.

A. Cr^{3+}

B. MnO_{4-}

C. $Cr_2O_7^{2-}$

D. Mn^{2+}

Answer: A

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45. Copper reduced NO_3^- into NO and NO_2 depending upon cone. Of HNO_3 in solution. Assuming $[Cu^{2+}] = 0.1M$ and $P_{NO} = P_{NO_2 = 10^{-3}}$ atm and using given data answer the following question:

$E^{\circ}_{Cu^{2+} | Cu} = +0.34$ volt

$E^{\circ}_{NO_3^-|NO} = +0.96$ volt

$E^{\circ}_{NO_{\#}^-|NO_3} = +0.79$ volt

at 298K $\frac{RT}{F}(2.303) = 0.06$ volt

E_{cell} for reduction of $NO_3^- \rightarrow NO$ by Cu(s), when $[HNO_3] = 1M$ is: [At T=298]

A. ~0.61

B. ~0.71

C. ~0.51

D. ~0.81

Answer: B

Watch Video Solution

46. Copper reduced NO_3^- into NO and NO_2 depending upon cone. Of HNO_3 in solution. Assuming $[Cu^{2+}] = 0.1M$ and $P_{NO} = P_{NO_2 = 10^{-3}}$ atm and using given data answer the following question:

$E^{\circ}_{Cu^{2+}|Cu} = +0.34$ volt

$E^{\circ}_{NO_3^-|NO} = +0.96$ volt

$E^{\circ}_{NO_{\#}^-|NO_3} = +0.79$ volt

at 298K $\frac{RT}{F}(2.303) = 0.06$ volt

At what HNO_3 concentration thermodynamic tendency for reduction of NO_3^- into NO and NO_3 by copper is same?

A. $10^{1/23}M$

B. $10^{0.56}M$

C. $10^{0.625}M$

D. $10^{0.12}M$

Answer: C

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47. Accidentally chewing on a stray fragmet of aluminium foil can causes a sharp tooth path if the aluminium comes in contact with an amalgam filing. The filing, an alloy of silver, tin and mercury, acts as the cathode of a tiny galvanic cell, the aluminium behaves as the anode, and salivas serves as the electrolyte. when the aluminium and the filling come in contact, and electric current passage from the aluminium to the filling which is sensed by a nerve in the tooth. Aluminium is oxidized at the anode, and O_2 gas is reduced to water at the cathode.

$E^{\circ}_{AI^{3+} \,/\, AI} = -1.66 E_{O_2 H^+ \,/\, H_2 O} 6^{\circ} = 1.23V$

Standard $E.\,M.\,F$ experienced by the person with dental filing is:

A. 0.43V

B. 2.89V

C. 3.98V

D. None of these

Answer: B

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48. The cavities in teeth is often filled with alloy of metals to avoid bacterial infections. However, when a person with dental filling ehew an active metal like aluminium foil acceidently, he experiences severe pain in teeth. The pain is due to a spontaneous discharge of a galvanic cell reaction which is set inside the mouth of person. The active metal serve as anode and dental filling act as inert electrode on which reduction of O_2 gas takes place.

$E^{\circ}_{Al^{3+} \mid Al} = -1.66$ volt: $E^{\circ}_{O_2, H^+ \mid H_2O} = +1.23$ volt

What is the net cell reaction assuming acidic conditions in the mouth?

A. $4Al(s) + 3O_2(g) + 6H_2O \rightarrow 4Al(OH)_3(s)$

B. $4Al(s) + 2O_2(g) + 8H^+(aq) \rightarrow 4Al^{3+} + 4H_{2O}$

C. $4Al(s) + 3O_2(g) + 12H^+(aq) \rightarrow 4Al^{3+}(aq) + 6H_2O$

D. $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

Answer: C

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49. Electrode potential data are used for predicting fessibility of any process. These are particularly useful in deciding products obtained on electrolysis and also on suitability of any substance for quantitative estimation. Some of the electrode potentials are given below:

$MnO_4^- + 5e^- + 8H^+ \rightarrow Mn^{+2} + H_2O$ $E^\circ = 1.52\ V$

$Fe^{+3} + e^- \rightarrow Fe^{+2}$ $E^\circ = 0.77\ V$

$2CO_2 + 2e^- \rightarrow C_2O_4^{2-}$ $E^\circ = 0.77\ V$

$Cl_2 + 2e^- \rightarrow 2Cl^-$ $E^\circ = +1.36\ V$

$2H_2O + 2e^- \rightarrow 2H_2 + 2OH^-$ $E^\circ = -0.83\ V$

$O_2 + 4e^- + 4H^+ \rightarrow 2H_2O$ $E^\circ = 1.23V$

$Mn^{+2} + 2e^- \rightarrow Mn$ $E^\circ = -1.18\ V$

$\left[\text{Take } \frac{R \times 298}{2.303} = 0.06\right]$

On adding $KMnO_4$ solution to an aqueous solution of ferrous oxalate in presence of HCl, it is observed that 0.1 "mole" of $Cl_2(g)$ and 0.2 "mole"s of $CO_2(g)$ was obtained. What must be the amount of $KMnO_4$ compound taken?

A. 0.1"mole"s

B. $\frac{0.4}{5}$ "mole"s

C. $\frac{0.3}{5}$ "mole"s

D. 0.5 "mole"s

Answer: A

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50. Electrode potential data are used for predicting fessibility of any process. These are particularly useful in deciding products obtained on electrolysis and also on suitability of any substance for quantitative estimation. Some of the electrode potentials are given below:

$MnO_4^- + 5e^- + 8H^+ \rightarrow Mn^{+2} + H_2O$	$E^\circ = 1.52\ V$
$Fe^{+3} + e^- \rightarrow Fe^{+2}$	$E^\circ = 0.77\ V$
$2CO_2 + 2e^- \rightarrow C_2O_4^{2-}$	$E^\circ = 0.77\ V$
$Cl_2 + 2e^- \rightarrow 2Cl^-$	$E^\circ = +1.36\ V$
$2H_2O + 2e^- \rightarrow 2H_2 + 2OH^-$	$E^\circ = -0.83\ V$
$O_2 + 4e^- + 4H^+ \rightarrow 2H_2O$	$E^\circ = 1.23V$
$Mn^{+2} + 2e^- \rightarrow Mn$	$E^\circ = -1.18\ V$

$$\left[\text{Take } \frac{R \times 298}{2.303} = 0.06\right]$$

An aqueous solution is taken comprising of Fe^{+3}, Mn^{+2}, Fe^{+2}, $C_2O_4^{2-}$ and Cl^- all at standard conditions. The solution is subjected to electrolysis using inert electrodes ensuring that pH of the solution remains as 7. Identify the option which is correct regarding products obtained [assume that except $[H^+]$ all other species involved are present at standard conditions].

A. At cathode Mn will be deposited initially

B. At cathode $H_2(g)$ will be dposited initially

C. At cathode $Cl_2(g)$ will be deposited initially

D. None of the above statements are correct

Answer: D

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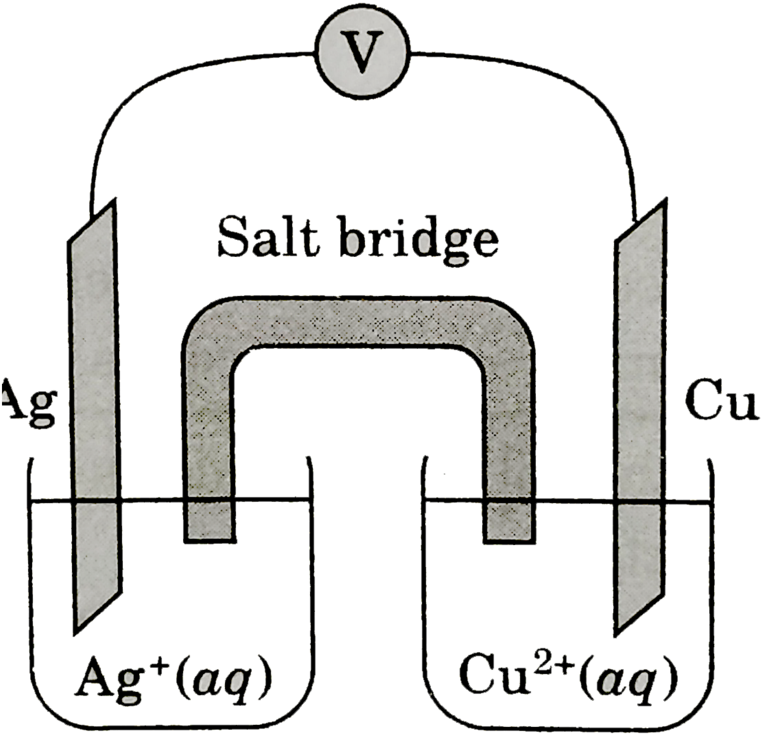
51. $Ag^+(aq) + e^- \rightarrow Ag(s)E^\circ = 0.80V$

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)E^\circ = 0.34V$



What is the value for ΔG° when $\left[Ag^{+}\right]=\left[Cu^{+}\right]=1.0M$?

A. $-44.4kJ$

B. $-88.8kJ$

C. $-242kJ$

D. $-374kJ$

Answer: B

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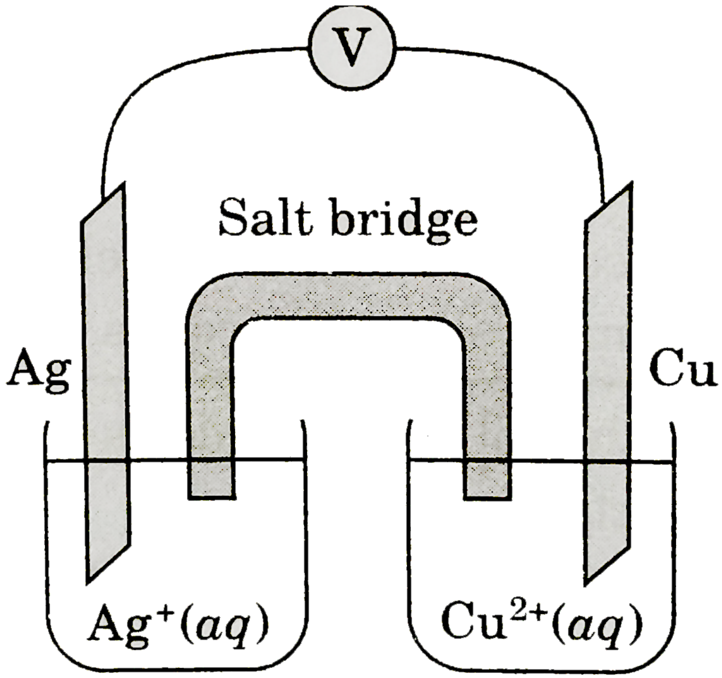
52. $Ag^{+}(aq) + e^{-} \rightarrow Ag(s) E^{\circ} = 0.80V$

$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s) E^{\circ} = 0.34V$



Which expression gives the voltage for this cell if $\left[Cu^{2+}\right] = 1.00M$ and $\left[Ag^{+}\right] = 0.010M$?

A. 0.46V+0.0591V

B. 0.46V+2xx0.0591V

C. 0.46V-0.0591V

D. 0.46V-2xx0.0591V

Answer: D

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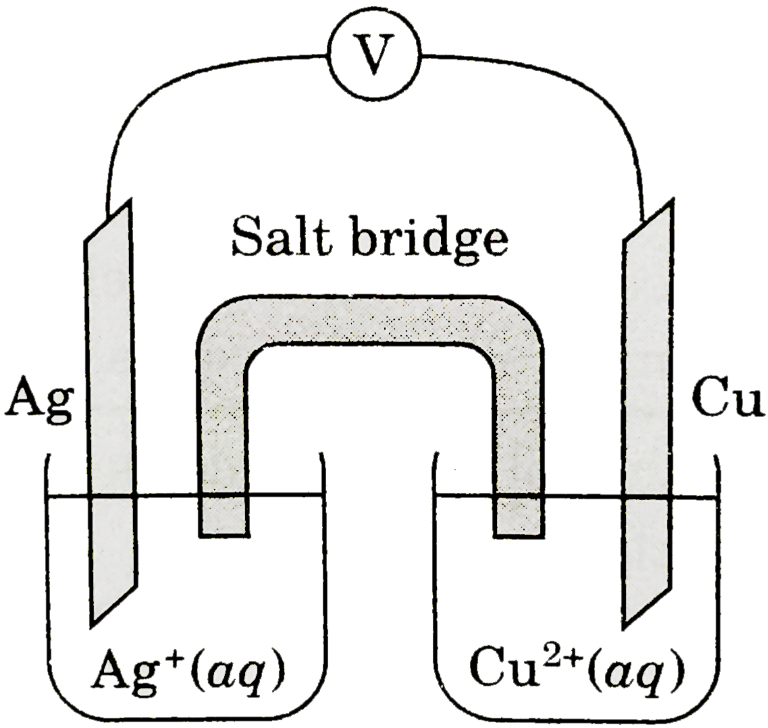
53. $Ag^{+}(aq)+e^{-}\rightarrow Ag(s)E^{\circ}=0.80V$

$Cu^{2+}(aq)+2e^{-}\rightarrow Cu(s)E^{\circ}=0.34V$



Which increases immediately if the surface area of the silver electrode is increased?

A. Overall cell voltage

B. Rate of change of $\left[Ag^{+}\right]$

C. Mass of Cu electrode

D. Change in ratio of electrode masses $\Delta\left(\frac{\text{Mass of Cu}}{\text{Mass of Ag}}\right)$

Answer: B

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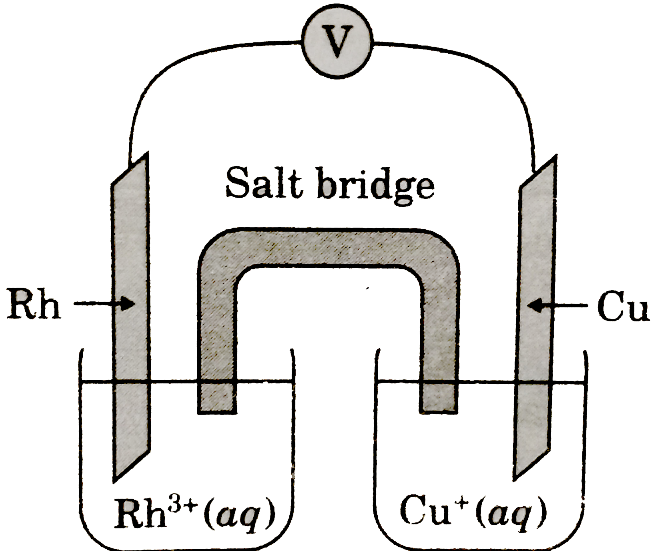
54. $Rh^{03+}(aq)+3e^{-}\rightarrow Rh(s)E^{\circ}=0.80V$

$Cu^{+}(aq)+e^{-}\rightarrow Cu(s)E^{\circ}=0.52V$



What is the direction of electronflow in the external circuit if the concentrations of Cu^{+} and Rh^{3+} are each 1M?

A. From the Rh anode to the Cu cathode

B. From the Rh cathode to the Cu anode

C. From the Cu anode to the Rh cathode

D. From the Cu cathode to the Rh anode

Answer: C

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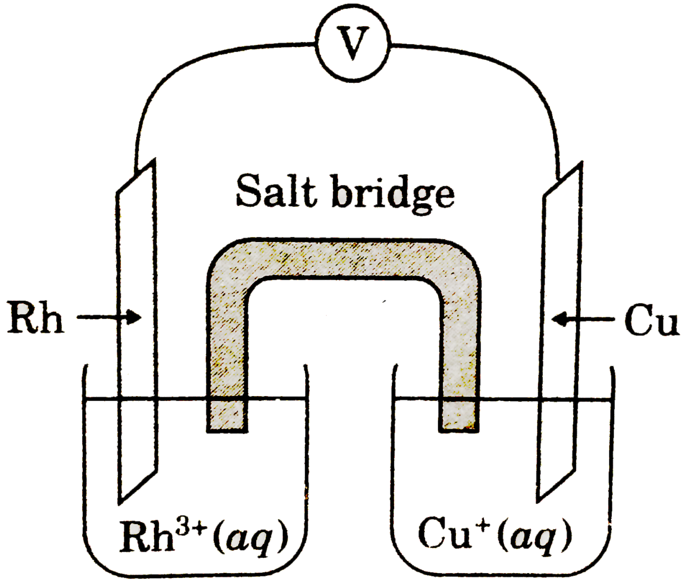
55. $Rh^{03+}(aq) + 3e^{-} \rightarrow Rh(s)E^{\circ} = 0.80V$

$Cu^{+}(aq) + e^{-} \rightarrow Cu(s)E^{\circ} = 0.52V$



What is the voltage of this cell if the concentrations of Cu^{+} and Rh^{3+} are each 1 M?

A. 0.28V

B. 0.76V

C. 1.32V

D. 2.36V

Answer: A

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56. $Al^{3+}(aq) + 3e^{-} \rightarrow Al(s)E^{\circ} = -1.66V$

$Mn^{2+}(aq) + 2e^{-} \rightarrow Mn(s)E^{\circ} = -1.18V$

What process occurs at the anode of a volatic cell utilizing these two half-reactions?

A. $Al(s) \rightarrow Al^{3+}(aq) + 3e^{-}$

B. $Al^{3+}(aq) + 3e^{-} \rightarrow Al(s)$

C. $Mn(s) \rightarrow Mn^{2+}(aq) + 2e^{-}$

D. $Mn^{2+}(aq) + 2e^{-} \rightarrow Mn(s)$

Answer: A

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57. $Al^{3+}(aq) + 3e^{-} \rightarrow Al(s)E^{\circ} = -1.66V$

$Mn^{2+}(aq) + 2e^{-} \rightarrow Mn(s)E^{\circ} = -1.18V$

What is the standard potential of a volaic cell produced by using these two half-reactions?

A. 0.04V

B. 0.48V

C. 2.84V

D. 6.68V

Answer: B

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58. $2Al(s) + 2Cu^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 2Cu(s)$

What is the value of E° for a volaic cell based on this reaction?

Reaction	E°
$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$	$+0.34V$
$Al^{3+}(aq) + 3e^{-} \rightarrow Al(s)$	$-1.66V$

A. 1.32V

B. 2.00V

C. 2.30V

D. 4.34V

Answer: B

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59. $2Al(s) + 2Cu^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 2Cu(s)$

What value should be used for n in the Nernst equation to determine the effect of changes in Al^{3+}(aq) and Cu^{2+} (aq) concentrations in this reaction?

A. 6

B. 5

C. 3

D. 2

Answer: A

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60.

Half Reaction	E° (V)
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	–0.763
$Cr^{3+}(aq) + e^- \rightarrow Cr^{2+}(aq)$	–0.408
$Tl^+(aq) + e^- \rightarrow Tl(s)$	–0.336
$Cu^{2+}(aq) + e^- \rightarrow Cu^+(aq)$	+0.161
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.769

Use the standard reduction potentials to find the standard cell potential E°, for the reaction:

$Zn(s) + 2Tl^+(aq) \rightarrow Zn^{2+}(aq) + 2Tl(s)$

A. 0.427V

B. 0.091V

C. $-0.091V$

D. $-0.427V$

Answer: A

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61.

Half Reaction	E° (V)
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	–0.763
$Cr^{3+}(aq) + e^- \rightarrow Cr^{2+}(aq)$	–0.408
$Tl^{+}(aq) + e^- \rightarrow Tl(s)$	–0.336
$Cu^{2+}(aq) + e^- \rightarrow Cu^{+}(aq)$	+0.161
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.769

Based on the standard reduction potentials above, which reaction(s) is (are) spontaneous?

(P) $Cr^{2+}(aq) + Fe^{3+}(aq) \rightarrow Cr^{2+}(aq) + Fe^{2+}(aq)$

(Q) $Cu^{2+}(aq) + Fe^{2+}(aq) \rightarrow Cu^{2+}(aq) + Fe^{3+}(aq)$

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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62. $2Ag^{+}(aq) + M(s) \rightarrow M^{2+}(aq) + 2Ag, E^{\circ} = 0.940V$

What is the value of E° for the half reaction, $M^{2+}(aq) + 2e^{-} \rightarrow M(s)$?

E° / V

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s) 0.99$

A. 0.658V

B. 0.141V

C. $-0.141V$

D. $-0.658V$

Answer: C

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63. $2Ag^{+}(aq) + M(s) \rightarrow M^{2+}(aq) + 2Ag, E^{\circ} = 0.940V$

Which change will cause the largest increase in the voltage of a cell based on the reaction above?

A. Doubling the $[Ag^{+}]$ from 1M to 2M

B. Doubling the amount of M(s)

C. Doubling the volume of the 1M Ag^{+} solution

D. Reducing the $[M^{2+}]$ from 1 M to 0.5M

Answer: A

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64. 0.1 "mole" $AgNO_3$ is added in 250 mL of saturated solution of AgCl at $25^{\circ}C$ without changing volume. Given: K_{sp} of $AgCl = 1.0 \times 10^{-10} M^2$

Ionic conductance of $Ag^{+} \text{ion} = 60\Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of Cl^{-} ion =$75\Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of NO_3^- ion $= 75\Omega^{-1}$

$[Cl^-]$ in the final solution is equal to :

A. $10^9 M$

B. $2.5 \times 10^{-10} M$

C. $10^{-5} M$

D. $2.5 \times 10^{-7} M$

Answer: B

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65. 0.1 "mole" $AgNO_3$ is added in 250 mL of saturated solution of AgCl at $25^\circ C$ without changing volume. Given: K_{sp} of $AgCl = 1.0 \times 10^{-10} M^2$

Ionic conductance of Ag^+ ion $= 60\Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of Cl^- ion $=75\Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of NO_3^- ion $= 75\Omega^{-1}$

If the solution is electrolysed using inert electrodes the expected electrode products are:

A. Ag at cathode and Cl_2 at anode

B. Ag at cathode and O_2 at anode

C. H_2 at cathode and Cl_2 at anode

D. H_2 at cathode and O_2 at anode

Answer: B

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66. 0.1 "mole" $AgNO_3$ is added in 250 mL of saturated solution of AgCl at $25^\circ C$ without changing volume. Given: K_{sp} of $AgCl = 1.0 \times 10^{-10} M^2$

Ionic conductance of $Ag^+ \text{ion} = 60 \Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of Cl^- ion $=75 \Omega^{-1} cm^2 \text{mol}^{-1}$

Ionic conductance of $NO_3^- \text{ion} = 75 \Omega^{-1}$

The conductivity of solution is:

A. $5.4 \times 10^{-2} \Omega^1 cm^{-1}$

B. $5.2 \times 10^{-2} \Omega^{-1} cm^{-1}$

C. $4.0 \times 10^{-2} \Omega^{-1} cm^{-1}$

D. $8.4 \times 10^{-2} \Omega^{-1} cm^{-2}$

Answer: A

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67. H_2O_2 can be produced by the ammonium hydrogen sulphate. Reactions occuring in electrolytic cell,

$NH_4HSO_4 \rightarrow NH_4^- + 2e^-$ (Anode)

$2SO_4^{2-} \rightarrow S_2O_8^{2-} + 2e^-$

$2H^+ + 2e^- \rightarrow H_2$ (Cathode)

Hydrolysis of ammonium persulphate:

$(NH_4)_2S_2O_8 + 2H_2O \rightarrow 2NH_4HSO_4 + H_2O_2$ Assume 100% yield of hydrolysis reaction.

What is the current efficiency when 100 Amp current is passed for 965 seconds in order to produce 17 gm of H_2O_2.

A. 0.2

B. 0.4

C. 0.8

D. 1

Answer: D

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68. H_2O_2 can be produced by the ammonium hydrogen sulphate. Reactions occuring in electrolytic cell,

$NH_4HSO_4 \rightarrow NH_4^- + 2e^-$ (Anode)

$2SO_4^{2-} \rightarrow S_2O_8^{2-} + 2e^-$

$2H^+ + 2e^- \rightarrow H_2$ (Cathode)

Hydrolysis of ammonium persulphate:

$(NH_4)_2S_2O_8 + 2H_2O \rightarrow 2NH_4HSO_4 + H_2O_2$ Assume 100% yield of hydrolysis reaction.

What volume of hydrogen gas at 1 atm and 273 K will be produced in cathode in previous question?

A. 22.4L

B. 11.2L

C. 5.6L

D. 2.8L

Answer: B

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69. H_2O_2 can be produced by the ammonium hydrogen sulphate.

Reactions occuring in electrolytic cell,

$NH_4HSO_4 \rightarrow NH_4^- + 2e^-$ (Anode)

$2SO_4^{2-} \rightarrow S_2O_8^{2-} + 2e^-$

$2H^+ + 2e^- \rightarrow H_2$ (Cathode)

Hydrolysis of ammonium persulphate:

$(NH_4)_2S_2O_8 + 2H_2O \rightarrow 2NH_4HSO_4 + H_2O_2$ Assume 100% yield of hydrolysis reaction.

How many "mole"s of electrons are to be passed in order to produce enough H_2O_2 which when reacted with excess of KI then liberated iodine required 100 mL of centimolar hypo solution.

A. 10^{-1}

B. 10^{-2}

C. 10^{-3}

D. 5×10^{-4}

Answer: C

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70. An element (X) having same cheical properties as that of hydrogen atom. The diatomic "mole"cule X_2 is gaseous in nature. The energy required to remove an electron from the outermost shell of (X) atom is 13.5eV. It is also found that the time taken for diffusion of equal volume of gaseous X_2 and O_2 at the same pressure is in the ratio $\sqrt{3}: 4$. the normal freezing point of pure X_2O is $0^{\circ} C$. However, on adding 0.02 "mole"s of a non-electrolyte solute to 0.8 "mole"s of X_2O, the freezing point of solution is found to be-$1.25^{\circ} C$. X-atom also obey Bohr's model.

When 3 gm of a weak monoprotic acid $(M_w = 60)$ is added to 0.8 "mole"s of X_2O, the resulting solution freeze at -3.75° C. What is the degree of dissociation for weak acid?

A. 0.10

B. 0.20

C. 0.30

D. 0.40

Answer: B

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71. An element (X) having same cheical properties as that of hydrogen atom. The diatomic "mole"cule X_2 is gaseous in nature. The energy required to remove an electron from the outermost shell of (X) atom is 13.5eV. It is also found that the time taken for diffusion of equal volume of gaseous X_2 and O_2 at the same pressure is in the ratio $\sqrt{3}: 4$. the normal freezing point of pure X_2O is $0^\circ C$. However, on adding 0.02 "mole"s of a non-electrolyte solute to 0.8 "mole"s of X_2O, the freezing point of solution is found to be-$1.25^\circ C$. X-atom also obey Bohr's model.

What amount of electricity is required to produce 3.3 gm of x_2 gas by electrolysis of X_2O?

A. $0.1F$

B. $1.1F$

C. $0.3F$

D. $0.4F$

Answer: D

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72. An element (X) having same cheical properties as that of hydrogen atom. The diatomic "mole"cule X_2 is gaseous in nature. The energy required to remove an electron from the outermost shell of (X) atom is 13.5eV. It is also found that the time taken for diffusion of equal volume of gaseous X_2 and O_2 at the same pressure is in the ratio $\sqrt{3}:4$. the normal freezing point of pure X_2O is $0^\circ C$. However, on adding 0.02 "mole"s of a non-electrolyte solute to 0.8 "mole"s of X_2O, the freezing point of solution is found to be-$1.25^\circ C$. X-atom also obey Bohr's model.

What will be the energy required to excite 5 (X) atoms to second exicted state?

A. 30eV

B. 60eV

C. 120eV

D. 15eV

Answer: B

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Match the column type

1. Mathc the following columns :

Column-I		Column-II	
(a)	$Zn \mid \underset{c_1}{Zn^{2+}} \parallel \underset{c_2}{Mg^{2+}} \mid Mg \; (c_1 = c_2)$	(p)	$E_{cell} = 0$
(b)	$Zn \mid Zn^{2+} \parallel Ag^+ \mid Ag$ at equilibrium	(q)	$E^\circ_{cell} = 0$
(c)	$Ag \mid \underset{c_1}{Ag^+} \parallel \underset{c_2}{Ag^+} \mid Ag \; (c_1 = c_2)$	(r)	$E^\circ_{cell} = +ve$
(d)	$Fe \mid \underset{c_1}{Fe^{+2}} \parallel \underset{c_2}{Ag^+} \mid Ag \; (c_1 = c_2)$	(s)	$E^\circ_{cell} = -ve$

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2. Match matrix $\left(E^\circ_{Ag^+/Ag} = 0.8 K_{sp}(AgCl) = 10^{-10}\right)$

Column-I		Column-II	
(a)	$Pt \mid H_2$ (0.1 bar) $\mid H^+$ (0.1 M) $\parallel H^+$ (1 M) $\parallel$ H_2 (0.01 bar) $\mid Pt$	(p)	Concentration cell
(b)	$Ag \mid AgCl$ (KCl, 0.1 M) $\parallel Ag^+$ (0.01 M) $\parallel Ag$	(q)	$E_{cell} > 0$
(c)	$Cu \mid Cu^{2+}$ (0.1 M) $\parallel Cu^{2+}$ (0.01 M) $\mid Cu$	(r)	$E^\circ_{cell} = 0$ but cell is working
(d)	$Pt \mid Cl_2$ (1 bar) $\mid HCl$ (0.1 M) $\parallel NaCl$ (0.1 M) $\mid Cl_2 \mid Pt$ (1 bar)	(s)	non working condition

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3.

Column-I		Column-II	
(a)	Very dilute solution of HCl	(p)	O_2 evolved at anode
(b)	Very dilute solution of NaCl	(q)	H_2 evolved at cathode
(c)	Concentrated solution of NaCl	(r)	Cl_2 evolved at anode
(d)	Fairly concentrated solution of $AgNO_3$	(s)	Ag deposition at cathode

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4. Match the following columns:

Column-I		Column-II	
(a)	Electrolytic cell	(p)	$-\Delta G^\circ$
(b)	nFE°_{cell}	(q)	Concentration cell
(c)	$E_{cell} = \frac{0.059}{n} \log \frac{C_{cathode}}{C_{anode}}$	(r)	96500 Coulombs
(d)	Diffusion of ions	(s)	Device converting electrical energy into chemical energy
(e)	1 Faraday	(t)	Salt bridge

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5. $Column - I$ | $Column - II$

$Column - I$	$Column - II$
(A)Conductance	$(p) Cm^{-1}$
(B)Specific condutance	$(q) Ohm^{-1} cm^2 mol^{-1}$
(C)Cell constant	$(r) Ohm^{1-}$
(D)Equivalent conductance	$(s) Ohm^{-1} cm^{-1}$
(E)Molar conductance	$(u) Ohm^{-1} cm^2$equivalent^{-1}

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6. Match the following columns

Column-I		Column-II	
(a)	Concentration cell	(p)	$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ + electrical energy
(b)	Spontaneous cell reaction	(q)	$E^\circ_{cell} = 0$
(c)	Daniel cell	(r)	$E_{cell} > 0$
(d)	Fuel cell	(s)	Galvanic cell

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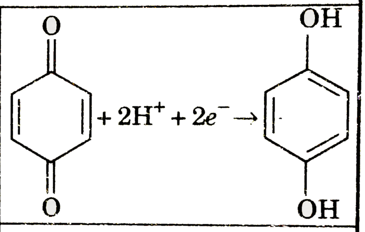
7. Match the following columns

	Column-I		Column-II
(a)	Concentration cell	(p)	
(b)	Electrode reversible with respect to anion	(q)	$Pt \mid Ce^{4+}, Ce^{3+}$
(c)	Quinhydrone electrode	(r)	$Hg \mid Hg_2Cl_2, KCl$
(d)	Redox-electrode	(s)	$Na(Hg) \mid NaCl \mid Na\ (Hg)$

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8. Match the following columns

	Column-I		Column-II
(a)	Oxidising agent	(p)	Disproportionation
(b)	Mn_3O_4	(q)	Redox reaction
(c)	C_8H_6	(r)	Decreases its oxidation number
(d)	$2Cu^{+} \rightarrow Cu^{2+} + Cu^{0}$	(s	Fractional oxidation number
(e)	$H_2O_2 + O_3 \rightarrow H_2O + 2O_2$	(t)	Oxidation number is -1

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9. Match the following columns

Column-I		Column-II	
(a)	Cell constant	(p)	$E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$
(b)	Anode	(q)	l/a
(c)	Conductance	(r)	Mass of product deposited by 1 coulomb of electricity
(d)	Electrochemical equivalent	(s)	$(\text{Resistance})^{-1}$
(e)	E°_{cell}	(t)	Involve oxidation

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10. Match the following columns

Column-I		Column-II	
(a)	Cathode	(p)	Primary cell
(b)	1 coulomb	(q)	Secondary cell
(c)	Dry cell	(r)	6.24×10^{18} electrons
(d)	Lead storage cell	(s)	Concentration cell
(e)	$Zn \mid Zn^{2+}$ (0.01 M) $\mid\mid Zn^{2+}$ (0.1 M) $\mid Zn$	(t)	Positive terminal of electrochemical cell

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11. Match the following columns

	Column-I		Column-II
(a)	$Zn \mid Zn^{2+}(C) \mid\mid Zn^{2+}(2C) \mid Zn$	(p)	Spontaneous cell reaction
(b)	$H_2(P) \mid HCl\,(1\,M) \mid\mid H_2SO_4\,(0.1\,M) \mid H_2(P)$	(q)	Working cell representation
(c)	$Cu \mid Cu^{2+}(0.01\,M) \mid\mid Ag^+\,(0.1\,M) \mid Ag$	(r)	Cell reaction work in backward direction
(d)	$AgCl \mid Ag(KCl, 0.1\,M) \mid\mid Ag^+\,(0.01\,M) \mid Ag$ (with $E^\circ_{cell} = 0.58$ V)	(s)	Concentration cell

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12.

	Column-I		Column-II
(a)	Conductivity (κ) increases	(p)	Depends on cell constant as well as concentration
(b)	Molar conductance (λ_m) increases	(q)	Independent of concentration as well as cell constant
(c)	Conductance (G)	(r)	With decrease in concentration but independent of cell constant
(d)	Molar conductance (λ^∞_m) at infinite dilution	(s)	With increase in concentration but independent of cell constant

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13. Match the terms given in Column I with the items given in Column II.

(One to one match only)

Column-I		Column-II	
(a)	Λ_m	(p)	Intensive property
(b)	$E^{\ominus}_{cell}$	(q)	Depends on number of ions/volume
(c)	κ	(r)	Extensive property
(d)	$\Delta_r G_{Cell}$	(s)	Increases with dilution

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14. Match the items of Column I and Column II on the basis of data given below:

(One to one match only)

$E^{\circ}_{F_2 | F^-}$ = 2.87 V, $E_{Li^+ | (Li)}$ = -3.5 V,

$E^{\circ}_{Au^{3+} \mid Au}$ = 1.4 V, $E^{\circ}_{Br_2 \mid Br^-}$ = 1.09V

Column-I		Column-II	
(a)	F_2	(p)	Metal is the strongest reducing agent
(b)	Li	(q)	Metal ion which is the weakest oxidising agent
(c)	Au^{3+}	(r)	Non-metal which is the best oxidising agent
(d)	Br^-	(s)	Unreactive metal
(e)	Au	(t)	Anion that can be oxidised by Au^{3+}
(f)	Li^+	(u)	Anion which is the weakest reducing agent
(g)	F^-	(v)	Metal ion which is an oxidising agent

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	Column-I		Column-II
(a)	$Zn_{(s)} \mid \underset{0.01\,M}{Zn^{+2}_{(aq)}} \parallel \underset{0.1\,M}{Zn^{+2}_{(aq)}} \mid Zn$	(p)	Spontaneous cell reaction
(b)	$\underset{1\,atm}{Pt\,(H_2)} \mid \underset{0.01\,M}{HCl} \parallel \underset{0.1\,M}{HCl} \mid \underset{1\,atm}{Pt\,(Cl_2)}$ $(E^{\circ}_{Cl_2/Cl^-} = 1.36\,V)$	(q)	EMF of cell is zero
(c)	$Cu_{(s)} \mid \underset{0.01\,M}{Cu^{+2}_{(aq)}} \parallel \underset{0.1\,M}{Ag^{+}_{(aq)}} \mid Ag_{(s)}$ $(E^{\circ}_{Ag^+/Ag} > E^{\circ}_{Cu^{+2}/Cu})$	(r)	Concentration cation in cathodic compartment decreases upt equilibrium
(d)	$Ag_{(s)} \mid AgCl_{(s)} \mid \underset{1\,M}{KCl_{(aq)}} \parallel \underset{0.1\,M}{Ag^{+}_{(aq)}} \mid Ag_{(s)}$	(s)	Standard EMF cell is zero
		(t)	Concentration Cl^- in anod compartment decreases

15.

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16. If AgCl $\Leftrightarrow Ag^+ + Cl^- \; K_{eq} = 10^{-10}$

$AgBr \Leftrightarrow Ag6(+) + Br(-) \; K_{eq} = 10^{-12}$

$Ag(NH_3)_2^+ \Leftrightarrow Ag6(+) + 2NH-(3) \; K_{eq} = 10^{)}(-8)$

(At 25° C assume $\frac{RT}{F}$ = 0.06)

Match the following columns:

	Columns-I (Cell)		Column-II (Standard cell potential (ε°) at 25° C)
(a)	$Ag(s) \mid AgBr(s)Br^{-}(aq) \parallel Cl^{-}(aq) \mid AgCl(s) \mid Ag(s)$	(p)	0 volt
(b)	$Ag(s) \mid AgCl(s) \mid Cl^{-}(aq) \parallel Ag^{+}(aq) \mid Ag(s)$	(q)	0.24 volt
(c)	$Ag(s) \mid AgBr(s) \mid Br^{-}(aq) \parallel Ag(NH_3)_2^{+}(aq) \mid Ag(s)$	(r)	0.12 volt
(d)	$Pt, H_2(g) \mid H^{+}(aq) \mid H_2(g), Pt$	(s)	0.6 volt

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Subjective type

1. The conductivity ofa solution may be taken to be directly proportional to the total concentration of the charge carriers (ions) present in it in many cases. Using the above, find the percent decrease in conductivity (k) of a solution of a week monoacidic base BOH when its 0.1 M solution is diluted to double its original volume. $\left(K_b = 10^{-5} f \text{ or } BOH\right)(take$ sqrt(50) = 7.07`) (mark the answer to nearest integer)

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2. At 0.04 M concentration, the molar conductivity of solution of an electrolyte is $5000\Omega^{-1}cm^2mol^{-1}$ while at 0.01 M concentration the value is $5100\Omega^{-1}cm^2mol^{-1}$. Making necessary assumption (Taking it as strong electrolyte) find the molar conductivity at infinite dilution and write percentage dissociation of strong electrolyte at 0.04 M.

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3. The EMF of the cell $M \mid M^{n+}$ (0.02 M) | H^(+) (1 M) | H_(2)(g) (1 atm), Pt at 25°C is 0.81 V. Calculate the valency of the metal if the standard oxidation potential of the metal is 0.76 V

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4. A current of 0.5 ampere when passed through $AgNO_3$ solution for 193 sec. deposited 0.108 g of Ag. Find the equivalent weight of Ag.

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5. A certain metal salt solution is electrolysed in series with a silver coulometer. The weights of silver and the metal deposited are 0.5094 g and 0.2653 g. Calculate the valency of the metal if its atomic weight is nearly that of silver.

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6. 3 Amp current was passed through an aquesous solution salt of unknown salt of Pd for 1hr. 2.977 g of Pd^{+n} was deposited at cathode. Find n (Given Atomic mass of Pd = 106.4)

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7. How long (in sec) a current of 2A has to be passed through a solution of $AgNO_3$ to coat a metal surface of $80cm^2$ with $5\mu m$ thick layer? Density of silver = $10.8g/cm^3$

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8. A fuell cell uses $CH_4(g)$ and forms CO_3^{2-} at the anode. It is used to power a car with 80 amp, for 0.96 hr. how many litres of $CH_4(g)$ (at 1 atm, 273 K) would be required? (V_(m) = 22.4 L/mol) (F = 96500). Assume 100% efficiency.

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9. In a conductivity cell, the two platinum electrodes, each of area 10sq. Cm are fixed 1.5 cm apart. The cell contained 0.05 N solution of a salt. If the two electrodes are just half dipped into the solution which has a resistance of 50 ohms, find equivalent conductance of the salt solution in $\Omega^{-1}cm^2eq^{-1}$.

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10. Given the equivalent conductance of sodium butyrate, sodium chloride and hydrogen chloride as 83, 127 and 426 mho $cm^2\ eq^{-1}$ at $25^\circ C$ respectively. Calculate the equivalent the equivalent conductance of butyric acid at infinite dilution in same units.

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11. Calcualte the emf of the cell in mV (at least first two digits must match with correct answer)

Ag(s), $AgIO_3$ | $Ag^+(xM)$, HIO_(3)$(1M)$ | |Zn^(2+)(1M)|$Zn(s)If$K_(sp) $= 3$ xx 10^(-8)f or AgIO_(3) and K_(a) $= \frac{1}{6}f$ or HIO_(3) and E_(cell)^(@)f or $2Ag +$ Zn^(2+)rightarrow2Ag^(+)$+Znis$-1.56`V

(log 3 = 0.48) (Take (RT)/(F) = 0.059)

(Give your answer in magnitude only)

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12. During the discharge of a lead storage battery, the density of sulphuric acid fell from 1.294 to 1.139 $g.\,ml^{-1}.H_2SO_4$ of density 1.294 gml^{-1} is $39\,\%$ and that of density 1.139 $g.\,ml^{-1}is$20%

$byweight. Thebaeryholds3.5Lofacid$ and $thevolumepracticallyrema \in s$

$< ethe\nu mberofamperehoursf$ or $whichthebaery\mu sthavebeenused. The$

Pb + SO_(4)^(2-) rightarrow PbSO_(4) + 2e^(-)$(Anodicreaction)$PbO-92) + 4H^(+) + SO_(4)^(2-) + 2e^(-) rightarrow PbSo_94) + 2H_(2)O` (Cathode reaction)

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13. A silver coulometer is in series with a cell electrolyzing water. In a time of 1 minute at a constant current 1.08 g silver get deposited on the cathode of the coulometer. What total volume (in mL at 1atm, 273K) of the gases would have produced in other cell. In this cell that the anodic and cathodic efficiencies were $90\,\%$ and 80% respectively. Assume the gases collected are dry. (Ag = 108) (molar volume of any ideal gas at 1atm and 273K = 22.4L)

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14. After electrolytes of NaCl solution with inert electrodes for a certain period of time 600 mL of the solution was left which was found to be 1N in NaOH. During the same time, 31.75 g of Cu deposited in the copper voltmeter in seris with the electrolytic cell. Calcualte the percentage yield of NaOH obtained.

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15. For the cells in opposition,

Zn(s) | ZnCl_(2)(sol).|AgCl(s)|Ag|AgCl(s)|

$C-(1)=0.02M$, $ZnCl_2(sol)$| Zn(s)

$C_2=0.5M$

Find out the emf (in millivolt) of the resultant cell. (take log 2 $=0.3$, $\frac{RT}{F}$ at 298 K = 0.060)

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16. At $Tl^{+} \mid Tl$ couple was prepared by saturating 0.1 M KBr with TlBr and allowing the Tl^{+} from the relatively insoluble bromide to equilibrate. This couple was observed to have a potential of -0443V with respect to $Pb6(2+) \mid Pb$ couple in which $Pb6(2+)$ was 0.1 M. Waht is K_{sp} of TlBr?

(Report answer in multiplication of 10^{-8})

$\left(E_{Pb^{2+}\frac{0}{P}b^{\wedge}(\circ)=}\right.$ -0.126, E_(Tl^(+)//Tl)^(@)` = -0.336V)

(Take antilog(0.5509) = 3.55, (2.303RT)/(F) = 0.059)

[Hint: Take Pb as anode]

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17. For the cell (at 1bar H_2 pressure) Pt|H_2(g) HX(m_(1), NaX(m_(2), NaCl(m_(3)|AgCl|Ag|Pt is found that the value of $E - E^{\circ} + RTF^{-1}$ in $\left[\frac{m_{HX}.\,mCl^{-}}{m_{X^{-}}}\right]$ approaches 0.2814 in the limit of zero concentration. Calcualte K_a for the acid HX at $25^{\circ}C$ expressing your answer as 10^{7}K_(a)`

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18. $NO_3^- \rightarrow NO_2$(acid medium), $E^{\circ 0 = 0.790}V$

$NO_3^- \rightarrow NH_3OH^+$ (Acid medium). $E^\circ = 0.731V$

At what pH, the above two will have same E value? Assume the concentration of all other species NH_3OH^+ except $\left[H^+\right]$ to be unity. (Give your answer by excluding the decimal places).

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19. EMF of the following cell is 0.634 volt at 298 K. ltbr. $Pt \mid H_{92}\big)(1atm)H^+(aq)||KCl(1N)|Hg_2Cl_2(s)|Hg$

Calculate pH of the anode compartment.

[Given: $E^\circ_{Cl^- \mid Hg_2Cl_2 \mid Hg}$ = 0.28 V and $\dfrac{2.303Rt}{F} = 0.059\Big]$

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20. During electrolytes 40 mA current is passed through 100 mL of 0.2 M $Fe^2(SO_4)_3$ solution for certain time. If 30 mL of 0.01 M $KMnO_{94})$ is decolourised by solutions in cell then find time of electrolysis in hours.

(Given: F= 96000C)

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21. 4.0 L of a buffer solution is prepared that is 1.0 M NaH_2PO_4 and 1.0 M Na_2HPO_4. The solution is divided into two halves between two compartments of a cell. Using Pt-electrodes, if current of 1.25 amp. Is passed for 200 minutes, pH of anode compartment is approximately: (Assuming only reaction is electrolysis of water)

(Given : $pKa_1 pKa_2$ and pKa_3 of H_3PO_4 are 3.07, 8.07, 12.07 and log 1.87 = 0.2648 and log 2.16 = 0.344)

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22. For the cell:

$Pt|Hg(l)|Hg_2Cl_2(s)|KCl(1M)||H^+|Q|H_2Q|Pt$

$E_{cell} = 0.1239V$ at 298 K, hence, pH of cathodic compartment is:

[Given: $E^\circ_{Calomel\,,Rp}$ = 0.28 V, $E^\circ_{Q\,|\,H_2Q}$ = +0.699 V]

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23. Find the EMF of cell (in volts) formed by connected two half cells:

$Pt(s) \mid MnO_4^-$ (0.1 M), $MnCl_2$(0.2M) HCl (1 M)

Pt(s) | $Cr_2O_7^{2-}(0.1M)$ $CrCl_3$(0.2M) HCl (0.7 M)$[Given$

E_(MnO_(4)^(-)|Mn^(2+))^(@) $= 1.51V$, E_(Cr_(2)O_(7)^(2-)| Cr^(3+) = 1.33

V]`

Give your answer by multiplying with 10.

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24. Calcualte acid dissociatioin constant for 0.1 M HCOOH if its solution shows a resistance of 50Ω filled in a cell having separation beween parallel electrodes 4 cm and cross section area of electrode $10cm^2$.

[Given: $\Lambda_m^{\infty}\left[Ca(H\mathbb{C}O)_2\right]$ = 230 Scm^2mol^-

$\lambda_m^{\infty}\left[CaCl_2\right]$ = 280 Scm^2mol^{-1}

λ_m^{∞} [HCl] =$425Scm^2mol^{-1}$]

In scientific notation, $x \times 10^{-y}$, find the value of y.

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25. H_2O_2 would have as oxidant with respect to how many of the following couples at standard condition?

(a) I_2 / I^-

(b) $S_2O_8^{2-} / SO_4^{2-}$

(C _ Fe^{3+} / Fe^{2+}

[Given:

$E^\circ_{O_2, H^+ | H_2O_2}$ = +0.69V, $E^\circ_{H_2O_2, H^+ | H_2O} = +1.77V$

$E^\circ_{I_2 | I^-} = 0.535V, E_{S_2O_8^{2-} | SO_4^{2-} = 2.0}$V

$E^\circ_{Fe^{3+} | Fe^{2+}} = 0.77V$

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26. For the cell reaction:

Hg_(2)Cl_(2)(s) + 2Ag(s) rightarrow 2Hg(l) + 2AgCl(s)

$Temperaturecoefficientofcellemfisfound \to be0.02$VK^(-1). $F \in d$

Delta_(r)S^(@)f or $cellreaction \in kJ$"mole"^(-) K^(-)`

Round off your answwer to the next higher integer)

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27. The possibility of plutonium waste leaking from nuclear faciliteis is a serious environmental problem.

If the solubility product of $Pu(OH)_4$ based on the following potentials measured in acid or basic solution is K_{sp}. Then

In $K_{sp} = \frac{-xF}{RT}$. Find x where 'F' is Faraday's constant

[Given : $Pu^{4+}(aq) + 4e^- \to Pu(s) E^\circ = -1.28V$.

$Pu(OH)_4(s) + 4e^- \to Pu(s) + 4OH^-(aq)$

$E = -2.03$ V at pH = 14]

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28. The conductivity of saturated solution of sparinlgy soluble salt $Ba_3(PO_4\_(2)$ is $1.2 \times 10^{-5} ohm^- cm^{-1}$. The limiting equivalent conductivities of $BaCl_2$, K_3PO_4 and KCl are 160, 140 and 100 $ohm^{-1}cm^2eq^{-1}$ respectively. If value of K_{sp} of $Ba_3(PO_{94}))_2$ is $A \times 10^{-25}$ then calcualte value of $A / 12$

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29. If electrode potential of following cell:

$Pt_s\left|Fe^{2+}_{aq}, Fe^{3+}_{aq}\right|\left|MnO^-_{4(aq)}, Mn^{2+}_{aq}, H^+_{aq}\right|Pt_s$

is X then calculate value of 20X.

[Given: $E_{MnO_4^- | Mn^{2+}}$ = 1.51 V,E_(Fe^(3+)|Fe^(2+))^(@) $= 0.78V, \frac{2.303RT}{F} = 0.06\Big]$

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30. 100 mL of 1M $AgNO_3$ solution is electrolysed using Pt electrode by passing a current of 9.65 A for 100 sec. Calcualte pH of solution after electrolysis.

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31. The emf of a cell formed by dipping two electrons of metal (M) in two solution of its salt in which the concentration of metal ion $\left(M^{n+}\right.$ is 0.1 M and 0.001 M was observed to be 0.03 volt at $25^{\circ}C$. What is the valency of the metal ion if the two half cells are connected using salt bridge?

[Given: 2.303 (RT)/F = 0.06]

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32. Resistance of an aqueous solution containing 2 "mole" NH_4Cl and is filled in between two electrodes which are 20 cm apart was found to be 100 ohm. Calcualte the $\lambda_m\left(Scm6(2)mol^{-}\right.$ for NH_4Cl(aq).

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33. The reduction potential of hydrogen electrode at 25°C when placed in a buffer solution is found to be $-0.413V$. The pH of the buffer is:

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34. E°_{cell} for the cell:

$Pt(s)|Fe^{2+}(aq)|Fe^{3+}(aq)||MnO_4^-(aq), H^+(aq)|Mn^{2+}(aq)|Pt$ is 0.8 volt.

[Given: $\Delta G^{\circ}_f, H_2O(l) = -230 kJmol^-$

$\Delta G^{\circ}_f, Fe^{3+}(aq) = 10.2 kJmol^-$

$\Delta G^{\circ}_f, Mn^{2+}(aq) = -229 kJmol^-$

$\Delta G^{\circ}_f, Fe^{2+}(aq) = -84 kJmol^{-1}$]

Determine magnitude of $\Delta G^{\circ}_f, MnO_4^-$ (aq) in $kJmol^-$

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35. A cell reaction is represented as

$Pt|H_2Q, Q, H^+||KCl|AgCl \mid Ag.$

$E^{\circ}_{H_2Q|Q}$ = $+0.4V$, $E^{\circ}_{Ag^+|Ag} = 0.8V$, $K_{sp} = 10^{-10}$, then calcualte a four digit number 'abcd' where:

(a) K_{eq} of the reaction

$H_2Q + 2AgCl \rightarrow 2Ag + 2Cl^- + 2H^+ + Q = 10^{ab}$

(b) Milli"mole"s of Ag formed if 1 litre of saturated solution of AgCl reacts with excess of hydroquinone (H_2Q) = 10^{-cd}. If initially negligible AgCl(s) is present.

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36. 0.5 L of a saturated solution of Ag_2CrO_4 is mixed with 0.5 L of 2×10^{-6} M $AgNO_3$. If concentration of $\left[CrO_4^{2-}\right]$after mixing is $\left(\frac{10^{-6}}{2}\right)$M and none of the ions undergo hydrolysis, then calculate a four digit number abcd where,

ab = $(K_{sp}$ of $Ag_2CrO_4 \frac{)}{10^{-19}}$ and cd = conductivity of final solution in terms of $10^{-8}\Omega^{-1}cm^{-1}$.

Assume temperature of the solution to be 298 K

[Given data: Molar conductance at infinite dilution in $\Omega^{-1}cm^2mol^{-1}$ are $\lambda_m^{\infty}\left(OH^{-}\right)$ = 200, $\lambda_m^{\infty}\ NO_3^{-}$ = 75, $\lambda_m^{\infty}\ Ag^{+}$ = 50 $\lambda_m^{\infty}\ CrO_4^{2-} = 100$

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37. A saturated solution of sparingly soluble base $Fe(OH)_3$ is found to have a specific conductance of $50 \times 10^{-4} ohm^{-1} m^{-1}$. Calcualte the value of a four digit number abcd where,

$ab = 3 \times 10^{16}$ times solubility product of $Fe(OH)_3$

cd =6×10^4 times solubility $Fe(OH_3$ in a solution of pH = 10

[Given : $\lambda_{eq}^{\infty} FeCl_3 = 15 \times 10^{-3} Sm^2 eq^{-1}$

$\lambda_{eq}^{\infty} NaCl = 13 \times 10^{-3} Sm^2 eq^{-1}$

$\lambda_{eq}^{\infty} NaOH = 23 \times 10^{-3} Sm^2 eq^{-1}$

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38. Two chambers in a galvanic cell have volume equal to 1 litre. If one chamber consists of a metal rod A dipped in A^{2+} ion and other consists of another metal rod B dipped in B^+ ion then from the given data answer the following questions:

$A(s) \left| A^{2+}(aq) 0.5M \right| \mid B^+(aq)(0.5M), B$ EMF = 0.991V

Calcualte the value of abcd, where

ab = E°_{cell} in volts and cd = 100 x approximate $\left[A^{2+}\right]$ ion when the current / reaction stops.

[take : $\frac{2.303RT}{F}$ = 0.06

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39. A current of 0.5 amp is passed through excess of molten mixture of Al_2O_3 and Na_3AlF_6 for 9.65 hours. The mass of Al (in mg) deposited at the cathode, with (100/12)% current efficiency is (Al = 27).

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Others

1. Which term represents the cahrge on one "mole" of electrons?

A. one Ampere

B. one Coulomb

C. one Faraday

D. one Volt

Answer: C

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2. How long must a current of 4.00 A be applied to a solution of $Cu^{2+}(aq)$ to produce 2.0 grams of copper metal?

A. $2.4 \times 10^4 s$

B. $1.5 \times 10^3 s$

C. $7.6 \times 10^2 s$

D. $3.8 \times 10^2 s$

Answer: B

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3. During the electrolysis of an aqueous solution of $AgNO_3$. What would happen to the mass of silver metal deposited if the current is doubled and the electrolysis time is decreased to $\frac{1}{2}$ of its initial value?

A. It would stay the same.

B. It would increase to twice its initial value.

C. It would decrease to $\frac{1}{4}$ of its initial value.

D. It would decrease to $\frac{1}{2}$ of its initial value.

Answer: A

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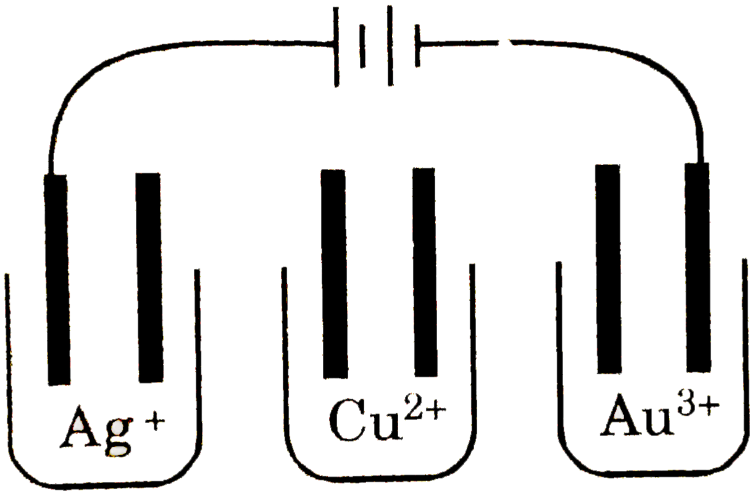
4. Solutions of $AgNO_3, CuSO_4$ and $AuCl_3$ are electrolyzed in the apparatus depicted. If the electrolysis is stopped before any of the ions are deposited completely, how do the number of "mole"s (n) of Ag, Cu and

Au deposited compare?



A. $n_{Ag} = n_{Cu} = n_{Au}$

B. $n_{Ag} < n_{Cu} < n_{Au}$

C. $n_{Ag} > n_{Cu} > n_{Au}$

D. $n_{Ag} = n_{Cu} > n_{Au}$

Answer: C

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5. According to the tabulated standard reduction potentials

$$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s) \qquad E^\circ = -2.38V$$
$$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq) \qquad E^\circ = -0.83$$
$$Br_2(l) + 2e^- \rightarrow 2Br^-(aq) \qquad E^\circ = 0.53V$$
$$O_2(g) + 4H^+(aq) \rightarrow 2H_2O(l) \rightarrow \qquad E^\circ = 1.23V$$

What products are formed during the electrolysis of an aqueous $MgBr_2$ solution?

A. Mg and H_2

B. H_2 and Br_2

C. H_2 and O_2

D. Mg and O_2

Answer: B

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6. During the electrolysis of a dilute solution of sulphuric acid, what substance is produced at the anode?

A. Hydrogen

B. Hydrogen sulphate

C. Oxygen

D. Sulphur dioxide

Answer: C

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7. Water can be decomposed by the passage on an electric current according to the following equation:

$2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

How many "mole"s of $H_2(g)$ can be produced from the passage of 4.8×10^{21} electrons?

A. 2.00×10^{-3}

B. 4.0×10^{-3}

C. 8.0×10^{-3}

D. $1.6 \times 10 \wedge (-2)$

Answer: B

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8. The mass of metal deposited by the electrolysis of an aqueous solution of metal ions increases in direct proportion to which property?

(P) Electrolysis current

(Q) Electrolysis time

(R) Metal ion charge

A. P only

B. R only

C. P and Q only

D. P,Q and R

Answer: C

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9. Which products are formed by the electrolysis of an aqueous solution of $AlCl_3$?

(P) Al(s) (Q) $Cl_2(g)$

(R) $H_2(g)$ (S) $O_2(g)$

A. P and R only

B. P and S only

C. Q and R only

D. Q and S only

Answer: C

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10. Electrolysis of dilute aqueous $NaCl$ solution was carried out by passing $10mA$ current. The time required to liberate $0.01mol$ of H_2 gas at the cathode is $(1F = 96500Cmol^{-1})$

A. 9.65×10^4sec

B. 19.3×10^4 sec

C. 28×10^4 sec

D. 38.6×10^4 sec

Answer: B

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