AIEEE 2009 Chemistry Paper

31. Knowing that the Chemistry of lanthanoids (*Ln*) is dominated by its +3 oxidation state, which of the following statements is *incorrect*?
    (1) Because of the large size of the *Ln* (III) ions the bonding in its compounds is predominently ionic in character.
    (2) The ionic sizes of *Ln* (III) decrease in general with increasing atomic number
    (3) *Ln* (III) compounds are generally colourless
    (4) *Ln* (III) hydroxides are mainly basic in character

31. (3) They are generally coloured due to incompletely filled *f*-subshell.

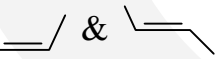
32. A liquid was mixed with ethanol and a drop of concentrated H_2SO_4 was added. A compound with a fruity smell was formed. The liquid was:
    (1) CH_3OH (2) $HCHO$ (3) $CH_3\ CO\ CH_3$ (4) $CH_3\ COOH$

32. (4) Formation of ester $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5$(fruit smell)

33. Arrange the carbanions, $(CH_3)_3\overline{C}, \overline{C}Cl_3, (CH_3)_2\overline{C}H, C_6H_5\overline{C}H_2,$ in order of their decreasing stability:
    (1) $C_6H_5\overline{C}H_2 > \overline{C}Cl_3 > (CH_3)_3\overline{C} > (CH_3)_2\ \overline{C}H$
    (2) $(CH_3)_2\ \overline{C}H > \overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_3\overline{C}$
    (3) $\overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_2\ \overline{C}H > (CH_3)_3\overline{C}$
    (4) $(CH_3)_3\overline{C} > (CH_3)_2\ \overline{C}H > C_6H_5\overline{C}H_2 > \overline{C}Cl_3$

33. (3) In $\overline{C}Cl_3$ there is $-I$ effect and $p\pi - d\pi$ back bonding from *C* to *Cl*.

34. The alkene that exhibits geometrical isomerism is **:**
    (1) Propene (2) 2 – methyl propene
    (3) 2 – butene (4) 2 – methyl – 2 – butene

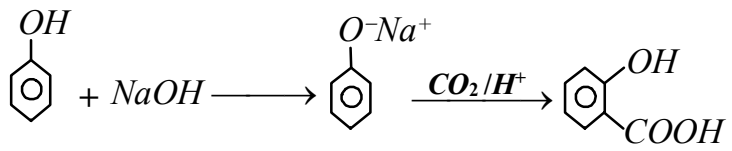
34. (3)  &

35. In which of the following arrangements, the sequence is ***not*** strictly according to the property written against it?
    (1) $CO_2 > SiO_2 < SnO_2 < PbO_2$: increasing oxidising power
    (2) $HF < HCl < HBr < HI$: increasing acid strength
    (3) $NH_3 < PH_3 < As\ H_3 < SbH_3$: increasing basic strength
    (4) $B < C < O < N$: increasing first ionization enthalpy

35. (3) Basicity order is $NH_3 > PH_3 > AsH_3 > SbH_3$.

36. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is:
(1) Benzoic acid (2) Salicylaldehyde (3) Salicylic acid (4) Phthalic acid

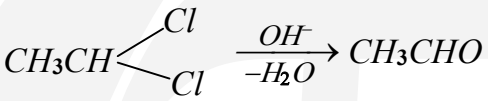
36. (3) Kolbe Schmidt reaction



37. Which of the following statements is ***incorrect*** regarding physisorptions?
(1) It occurs because of van der Waal's forces
(2) More easily liquefiable gases are adsorbed readily
(3) Under high pressure it results into multi molecular layer on adsorbent surface
(4) Enthalpy of adsorption ($\Delta H_{\mathbf{adsorption}}$) is low and positive

37. (4) Enthalpy of adsorption is always negative.

38. Which of the following on heating with aqueous *KOH*, produces acetaldehyde?
(1) $CH_3\ COCl$ (2) $CH_3\ CH_2\ Cl$ (3) $CH_2\ Cl\ CH_2\ Cl$ (4) $CH_3\ CHCl_2$

38. (4) 

39. In an atom, an electron is moving with a speed of 600 m / s with an accuracy of 0.005%. Certainity with which the position of the electron can be located is ($h = 6.6 \times 10^{-34}$ kg m^2s^{-1}, mass of electron, $e_m = 9.1 \times 10^{-31}$ kg):
(1) 1.52×10^{-4} m (2) 5.10×10^{-3} m (3) 1.92×10^{-3} m (4) 3.84×10^{-3} m

39. (3) $\Delta x.m\Delta v = (h / 4\pi)$, $\therefore\ \Delta x = 1.92 \times 10^{-3}$ m

40. In a fuel cell methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is $CH_3OH(l) + 3/2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$
At 298 K standard Gibb's energies of formation for $CH_3OH(l)$, $H_2O(l)$ and CO_2 (g) are – 166.2, –237.2 and –394.4 kJ mol^{-1} respectively. If standard enthalpy of combustioin of methanol is –762 kJ mol^{-1}, efficiency of the fuel cell will be:
(1) 80% (2) 87% (3) 90% (4) 97%

40. (4) $\Delta G_{\mathbf{rexn}} = -2 \times 237.2 - 394.4 + 166.2 = -702.6$
$\therefore$ efficiency = (– 706.2) / (– 726) × 100 = 97%

41. Two liquids *X* and *Y* form an ideal solution. At 300 K, vapour pressure of the solution containing 1 mol of *X* and 3 mol of *Y* is 550 mm *Hg*. At the same temperature, if 1 mol of *Y* is further added to this solution, vapour pressure of the solution increases by 10 mm *Hg*. Vapour pressure (in mm *Hg*) of *X* and *Y* in their pure states will be, respectively:
(1) 200 and 300 (2) 300 and 400 (3) 400 and 600 (4) 500 and 600

41. (3) $P_x + 4\ P_y = 560 \times 5$; $P_x + 3P_y = 550 \times 4$ $\therefore\ P_y = 600$; $P_x = 400$.

42. The half life period of a first order chemical reaction is 6.93 minutes. The time required for the completion of 99% of the chemical reaction will be (log 2 = 0.301) :
(1) 230.3 minutes (2) 23.03 minutes (3) 46.06 minutes (4) 460.6 minutes

42. (3) $t = (2.303 / \lambda) \log (100 / 1)$; $\lambda = (0.693 / 6.93)$
$= (2.303 / 0.1) \times 2 = 46.06$ m

43. Given $E°_{Fe3+/Fe} = -0.036$ V, $E°_{Fe2+/Fe} = -0.439$ V.
The value of standard electrode potential for the change, $Fe^{3+}_{(aq)} + e^- \rightarrow Fe^{2+}_{(aq)}$ will be :
(1) – 0.072 V (2) 0.385 V (3) 0.770 V (4) – 0.270 V

43. (3) $x + 2 \times (-0.439) = 3 \times (0.036)$ $\therefore$ 0.770 V

44. On the basis of the following thermochemical data : ($\Delta fG° H^+_{(aq)} = 0$)
$H_2O\ (l) \rightarrow H^+_{(aq)} + OH^-_{(aq)}$; $\Delta H = 57.32$ kJ
$H_2\ (g) \rightarrow ½O_2\ (g) + H_2O(l)$; $\Delta H = -286.20$ kJ
The value of enthalpy of formation of OH^- ion at 25°C is :
(1) – 22.88 kJ (2) – 228.88 kJ (3) +228.88 kJ (D) – 343.52 kJ

44. (2) $57.32 = x + 286.20$ $\therefore x = -228.88$ kJ

45. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom ?
(1) 108 pm (2) 127 pm (3) 157 pm (D) 181 pm

45. (2) $\sqrt{2} \times 361 = 4r$ $\therefore r =$ 127 pm

46. Which of the following has an optical isomer?
(1) $[CO(NH_3)_3Cl]^+$ (2) $[CO(en)\ (NH_3)_2]^{2+}$
(3) $[CO(H_2O)_4\ (en)]^{3+}$ (4) $[CO(en)_2\ (NH_3)_2]^{3+}$

46. (4) *c*is-isomer is optically active.

47. Solid $Ba(NO_3)_2$ is gradually dissolved in a 1.0×10^{-4} M Na_2CO_3 solution. At what concentration of Ba^{2+} will a precipitate begin to form?
(K_{sp} for $BaCO_3 = 5.1 \times 10^{-9}$) :
(1) 4.1×10^{-5} M (2) 5.1×10^{-5} M
(3) 8.1×10^{-8} M (4) 8.1×10^{-7} M

47. (2) $s = (5.1 \times 10^{-9}) / (1 \times 10^{-4}) = 5.1 \times 10^{-5}$ M

48. Which one of the following reactions of Xenon compounds is not feasible?
(1) $XeO_3 + 6\ HF \rightarrow XeF_6 + 3H_2O$
(2) $3XeF_4 + 6H_2O \rightarrow 2Xe + XeO_3 + 12\ HF + 1.5\ O_2$
(3) $2XeF_2 + 2H_2O \rightarrow 2Xe + 4HF + O_2$
(4) $XeF_4 + RbF \rightarrow Rb[XeF_7]$

48. (1) XeO_3 is acidic.

49. Using MO theory predict which of the following species has the shortest bond length?
(1) O_2^{2+} (2) O_2^+ (3) O_2^- (4) O_2^{2-}

49. (1) O_2^{2+} has highest bond order of 3.

50. In context with the transition elements, which of the following statements is incorrect?

(1) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.
(2) In the highest oxidation states, the transition metal show basic character and form cathonic complexes.
(3) In the higest oxidation states of the first five transition elements (*Sc* to *Mn*), all the 4*s* and 3*d* electrons are used for bonding.
(4) Once the d^5 configuration is exceeded, the tendency to involves all the 3*d* electronss in bonding decreases.

50. (2) With increase in oxidation state acidic character increases.

51. Calculate the wavelength (in nanometer) associated with a proton moving at 1.0×10^3 ms^{-1}
(Mass of proton = 1.67×10^{-27} kg and $h = 6.63 \times 10^{-34}$ Js) :
(1) 0.032 nm (2) 0.40 nm (3) 2.5 nm (4) 14.0 nm

51. (2) $\lambda = (6.63 \times 10^{-34+27-3}) / (1.67) = 3.97 \times 10^{-10} = 0.40$ nm

52. A binary liquid solution is prepared by mixing *n*-heptane and ethanol. Which one of the following statments is correct regarding the behaviour of the solution?
(1) The solution formed is an ideal solution
(2) The solution is non-ideal, shownign +ve deviation from Raoult's Law.
(3) The solution is non-ideal, showing –ve deviation from Raoult's Law.
(4) *n*-heptane shows +ve deviation while ethanol shows – ve deviation from Raoult's Law.

52. (2) The solution shows positive deviation.

53. The number of stereoisomers possible for a compound of the moleuclar formula $CH_3 - CH = CH - CH(OH) - Me$ is :
(1) 3 (2) 2 (3) 4 (4) 6

53. (3) It has four stereoisomers.

54. The IUPAC name of neopentane is :
(1) 2-methylbutane (2) 2,2- dimethylpropane
(3) 2- methylpropane (4) 2,2- dimethylbutane

54. (2)

55. The set representing the correct order of ionic radius is :
(1) $Li^+ > Be^{2+} > Na^+ > Mg^{2+}$ (2) $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$
(3) $Li^+ > Na^+ > Mg^{2+} > Be^{2+}$ (4) $Mg^{2+} > Be^{2+} > Li^+ > Na^+$

55. (2)

56. The two functional groups present in a typical carbohydrate are :
(1) $-OH$ and $-COOH$ (2) $-CHO$ and $-COOH$
(3) $> C = O$ and $-OH$ (4) $-OH$ and $-CHO$

56. (3) Carbohydrates contain both aldoses and ketoses.

57. The bond dissociation energy of B - F in BF_3 is 646 kJ mol^{-1} whereas that of C- F in CF_4 is 515 kJ mol^{-1}. The correct reason for higher B - F bond dissociation energy as compared to that of C - F is :
(1) smaller size of B-atom as compared to that of C-atom.
(2) stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4.
(3) significant $p\pi$-$p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4.
(4) lower degree of $p\pi$-$p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4.

57. (3)

58. In Cannizzaro reaction given below

$$2Ph\ CHO \xrightarrow{:\overset{\ominus}{O}H} PhCH_2OH + PhC\ddot{O}_2^{\ominus}$$

the slowest step is :
(1) the attack of $:\overset{\ominus}{O}H$ at the carboxyal group
(2) the transfer of hydride to the carbonyl group
(3) the abstraction of proton from the carboxylic group
(4) the deprotonation of $PhCH_2OH$

58. (2) Hydride transfer is the rate determining step.

59. Which of the following pairs represents linkage isomers?
(1) $[Cu(NH_3)_4]\ [PtCl_4]$ and $[Pt(NH_3)_4]\ [CuCl_4]$
(2) $[Pd\ (P\ Ph_3)_2\ (NCS)_2]$ and $[Pd\ (P\ Ph_3)_2\ (SCN)_2]$
(3) $[\ CO\ (NH_3)_5\ NO_3]\ SO_4$ and $[CO(NH_3)_5SO_4]\ NO_3$
(4) $[Pt\ Cl_2(NH_3)_4]\ Br_2$ and $[Pt\ Br_2(NH_3)_4]Cl_2$

59. (2)

60. Buna- N synthetic rubber is a copolymer of :
(1) $H_2C = CH - \overset{\overset{Cl}{|}}{C} = CH_2$ and $H_2C = CH - CH = CH_2$
(2) $H_2C = CH - CH = CH_2$ and $H_5C_6 - CH = CH_2$
(3) $H_2C = CH - CN$ and $H_2C = CH - CH = CH_2$
(4) $H_2C = CH - CN$ and $H_2C = CH - \underset{\underset{CH_3}{|}}{C} = CH_2$

60. (3)