PRACTICE SET-1

1. In the final answer of the expression $\frac{(29.2-20.2)(1.79\times10^5)}{1.37}$. The number of significant figures is:
a. 1 **b.** 2 **c.** 3 **d.** 4

2. 81.4 *g* sample of ethyl alcohol contains 0.002 *g* of water. The amount of pure ethyl alcohol to the proper number of significant figures is:
a. 81.398 g **b.** 71.40 g **c.** 91.4 g **d.** 81 g

3. The coordination number of a metal crystallising in a hexagonal close-packed structure is:
a. 12 **b.** 4 **c.** 8 **d.** 6

4. In a solid 'AB' having the NaCl structure, 'A' atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is:
a. AB_2 **b.** A_2B **c.** A_4B_3 **d.** A_3B_4

5. The molarity of pure water is:
a. 55.6 **b.** 18 **c.** 1 **d.** 5.56

6. The freezing point of 1% solution of sodium carbonate in water will be:
a. 0°C **b.** Below 0°C
c. 1° **d.** 3°

7. The ratio of root mean square velocity to average velocity of a gas molecule at a particular temperature is:
a. 1.086:1 **b.** 1:1.086
c. 2:1.086 **d.** 1.086:2

8. The temperature at which a real gas obeys the ideal gas laws over a wide range of pressure is:
a. critical temperature **b.** Boyle temperature
c. inversion temperature **d.** reduced temperature

9. Proton was discovered by
a. Chadwick **b.** Thomson
c. Goldstein **d.** Bohr

10. The nature of anode rays depends upon:
a. Nature of electrode **b.** Nature of residual gas
c. Nature of discharge tube **d.** All the above

11. The equivalent weight of $MnSO_4$ is half of its molecular weight when it converts to:
a. Mn_2O_3 **b.** MnO_3
c. MnO_4^- **d.** MnO_4^{2-}

12. The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is:
a. $+3$ **b.** $+2$ **c.** $+1$ **d.** -4

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

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

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

$2H^+(aq)+2e^- \rightleftharpoons H_2(g)$ $\quad E^\circ = 0.000$ V

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

Which is the strongest reducing agent?
a. $Zn(s)$ **b.** $Cr(s)$ **c.** $H_2(g)$ **d.** $Fe^{2+}(aq)$

14. Faraday's laws of electrolysis are related to the:
a. atomic number of the cation
b. atomic number of the anion
c. equivalent weight of the electrolyte
d. speed of the cation

15. The compound which contains both ionic and covalent bonds is:
a. CH_4 **b.** H_2 **c.** KCN **d.** KCl

16. The total number of electrons that take part in forming the bonds in N_2 is:
a. 2 **b.** 4 **c.** 6 **d.** 10

17. For equilibrium reaction $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$ relation in between K_p and K_c is?
a. $K_p - K_c$ **b.** $K_p = 2K_c$
c. $K_c > K_p$ **d.** $K_c < K_p$

18. The unit of equilibrium constant for the gaseous reaction $2NO(g) \rightleftharpoons N_2O_2(g)$ is?
a. atm **b.** atm^{-1} **c.** atm^2 **d.** no unit

19. Given that the dissociation constant for H_2O is $K_w = 1\times10^{-14}\,mole^2/litre^2$. What is the pH of a 0.001 molar KOH solution?
a. 10^{-11} **b.** 10^{-3} **C.** 3 **D.** 11

20. The pH of 0.1 M solution of the following salts increases in the order:
a. $NaCl < NH_4Cl < NaCN < HCl$
b. $HCl < NH_4Cl < NaCl < NaCN$
c. $NaCN < NH_4Cl < NaCl < HCl$
d. $HCl < NaCl < NaCN < NH_4Cl$

21. The rate constant of a reaction depends on:

a. temperature

b. initial concentration of the reactants

c. time of reaction

d. extent of reaction

22. The specific rate constant of a first order reaction depends on the:

a. concentration of the reactant

b. concentration of the product

c. time

d. temperature

23. Size of colloidal particles is:

a. $0.1\text{m}\mu$ to $0.001\text{m}\mu$

b. 10μ to 20μ

c. $0.05\text{m}\mu$ to $0.1\text{m}\mu$

d. 25μ to 30μ

24. Which of the following electrolytes is most effective in the coagulation of gold solution?

a. $NaNO_3$ **b.** $K_4[Fe(CN)_6]$

c. Na_3PO_4 **d.** $MgCl_2$

25. The difference between heats of reaction at constant pressure and constant volume for the reaction $2C_6H_6(l)+15O_2 \longrightarrow 12CO_2(g)6H_2(l)$ at 25°C in kJ is:

a. -7.43 **b.** $+3.72$

c. -3.72 **d.** $+7.43$

26. For an endothermic reaction, where ΔH represents the enthalpy of the reaction in kJ/mol, the minimum value for the energy of activation will be:

a. less than ΔH **b.** zero

c. more than ΔH **d.** equal to ΔH

27. An isotone of $^{76}_{32}Ge$ is:

a. $^{77}_{32}Ge$ **b.** $^{77}_{33}As$

c. $^{77}_{34}Se$ **d.** $^{78}_{36}Se$

28. The triad of nuclei that is isotonic is:

a. $^{14}_{6}C,\ ^{15}_{7}N,\ ^{17}_{9}F$ **b.** $^{12}_{6}C,\ ^{14}_{7}N,\ ^{19}_{9}F$

c. $^{14}_{6}C,\ ^{14}_{7}N,\ ^{17}_{9}F$ **d.** $^{14}_{6}C,\ ^{14}_{7}N,\ ^{19}_{9}F$

29. The bond between carbon atom A and carbon atom B in compound $N \equiv \underset{1}{C} - \underset{2}{C}H - CH_2$ involves the hybridisation as:

a. sp^2 and sp^2 **b.** sp^3 and sp

c. sp and sp^2 **d.** sp and sp

30. Polarisation of electrons in acrolein may be written as:

a. $H_2^{\delta-}C = CH - \overset{\delta+}{\underset{\|}{C}}(O) - H$ **b.** $H_2^{\delta-}C = CH - \overset{\delta+}{\underset{\|}{C}}(O) - H$

c. $H_2^{\delta-}C = \overset{\delta+}{C}H - \overset{\delta+}{\underset{\|}{C}}(O) - H$ **d.** $H_2\overset{\delta+}{C} = CH - \overset{\delta-}{\underset{\|}{C}}(O) - H$

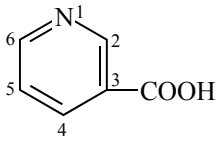
31. Assign the IUPAC name for the following compound.

$CH_3 - CH_2 - CH = N - NH_2$

a. N-aminopropane **b.** N-aminopropanal

c. Propanal hydrazone **d.** Propyl hydrazone

32. What is the IUPAC name of the compound?



a. Carboxypyridine

b. Pyridine-3-carboxylic acid

c. Pyridine-1-carboxylic acid

d. None of the above

33. Marsh gas mainly contains?

a. C_2H_2 **b.** CH_4

c. H_2S **d.** CO

34. Which of the following will decolourise alkaline $KMnO_4$ solution?

a. C_3H_8 **b.** CH_4

c. CCl_4 **d.** C_2H_4

35. Dehydration of 1-propanol by the use of H_2SO_4 and subsequent treatment with HI gives:

a. $CH_3CH_2CH_2I$ **b.** $CH_3CH(I)CH_3$

c. $CH_2 = CHCH_2I$ **d.** $ICH = CHCH_3$

36. Identify Z in the reaction:

$C_2H_5I \xrightarrow{\text{alc KOH}} X \xrightarrow{Br_2} Y \xrightarrow{KCN} Z$

a. CH_3CH_2CN **b.** $CNCH_2CH_2CN$

c. $BrCH_2CH_2CN$ **d.** $BrCH = CHCN$

37. Methylated spirit is:

a. Methanol **b.** Methanol + ethanol

c. Methanoic acid **d.** Methanamide

38. Carbolic acid is:

a. Phenol **b.** Phenyl benzoate

c. Phenyl acetate **d.** Salol

39. IUPAC name of CH_3COCH_3 is:

a. Acetone **b.** 2-propanone

c. Dimethyl ketone **d.** Propanal

40. Ethanediol has which functional group(s)?

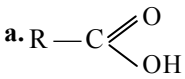
a. One ketonic

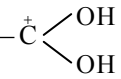
b. Two aldehydic

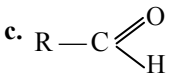
c. One double bond

d. Two double bond

41. Which of the following structure of carboxylic acid accounts for the acidic nature?

a. 

b. 

c. 

d. None of these

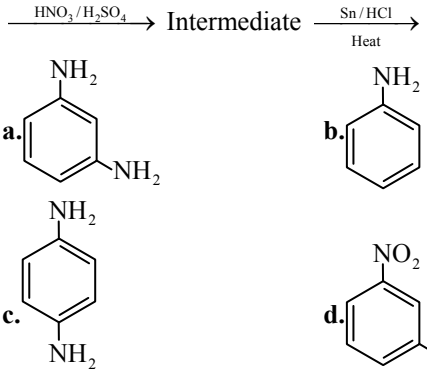
42. Acetoacetic ester behaves as:

a. An unsaturated hydroxy compound

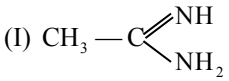
b. A keto compound

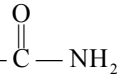
c. Both of these ways

d. None of these

43. 

44. The correct order of basicities of the following compounds is:

(I)  (II) $(CH_3)_2NH$

(III) $CH_3 — CH_2 — NH_2$ (IV) 

a. (II) > (I) > (III) > (IV) **b.** (I) > (III) > (II) > (IV)

c. (III) > (I) > (II) > (IV) **d.** (I) > (II) > (III) > (IV)

45. Whether small molecules liberate in addition polymerisation?

a. Yes

b. No

c. Sometimes

d. Only H_2O

46. The solubility of $Ca_3(PO_4)_2$ in water is y mol/L. Its solubility product is:

a. $6y^2$ **b.** $36\ y^4$

c. $64\ y^5$ **d.** $108\ y^5$

47. A physician wishes to prepare a buffer solution at pH = 3.85 that efficiently resists changes in pH yet contains only small concentration of the buffering agents. Which of the following weak acids together with its sodium salt would be best to use?

a. 2, 5-Dihydroxy benzoic acid ($pK_a = 2.97$)

b. Acetoacetic acid ($pK_a = 3.58$)

c. m-Chlorobenzoic acid ($pK_a = 3.98$)

d. p-Chlorocinnamic acid ($pK_a = 4.41$)

48. The pH of a 10^{-10} M NaOH solution is nearest to

a. 10 **b.** 7

c. 4 **d.** –10

49. A weak acid HX has the dissociation constant 1×10^{-5} M. It forms a salt NaX on reaction with alkali. The degree of hydrolysis of 0.1 M solution of NaX is

a. 0.0001% **b.** 0.01%

c. 0.1% **d.** 0.15%

50. When equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed, the hydroxide ion concentration is

a. 7.0 **b.** 1.04

c. 12.65 **d.** 2.0

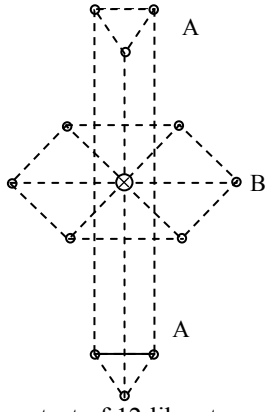
Answers and Solutions

1. **(b)** $\frac{(29.2-20.2)(1.79\times10^5)}{1.37} = \frac{9.0\times1.79\times10^5}{1.37}$

Least precise terms i.e., 9.0 has only two significant figures. Hence, final answer will have two significant figures.

2. **(a)** Pure ethyl alcohol $= 81.4 - 0.002 = 81.398$.

3. **(a)** There consecutive layers of atoms in hexagonal close packed lattice is shown below:



Atom X is in contact of 12 like atoms, 6 from layer B and 3 from top and bottom layers A each.

4. **(d)** In NaCl, Na^+ occupies body centre and edge centres while Cl^{-1} occupies corners and face centres, giving four Na^+ and four Cl^{-1} per unit cell. In the present case A represent Cl^{-1} and B represent Na^+. Two face centres lies on one axis.

$\Rightarrow$ Number of A removed $= 2 \times \frac{1}{2} = 1$

Number of B is removed because it is not present on face centres.

$\Rightarrow$ A remaining $= 4 - 1 = 3$

B remaining = 4

Formula = A_3B_4

5. **(a)** 1 mole of water $= 18\,g$,

Wt. of 1 L water $= 1000\,g$

Molarity of $H_2O = \frac{1000}{18} = 55.6$

6. **(b)** There is lowering in freezing point on the addition of a solution.

7. **(a)** The two types of speeds are defined as; Root mean square speed $(u_{rms}) = \sqrt{\frac{3RT}{M}}$

Average speed $(u_{avg}) = \sqrt{\frac{8RT}{\pi M}}$

For the same gas, at a given temperature, M and T are same, therefore

$$\frac{u_{rms}}{u_{avg}} = \sqrt{\frac{3RT}{M}} : \sqrt{\frac{8RT}{\pi M}} = \sqrt{3} : \sqrt{\frac{8}{\pi}} = \sqrt{3} : \sqrt{2.54} = 1.085 : 1$$

8. **(b)** It is the Boyle's temperature T_B. At Boyle's temperature, the first virial coefficient (b) vanishes and real gas approaches ideal behaviour.

$T_B = \frac{a}{Rb}$ Here, 'a' and 'b' are van der Waals' constants.

9. **(c)** Proton is represented by *p* having charge +1 discovered in 1988 by Goldstein.

10. **(b)** The nature of anode rays depends upon the nature of residual gas.

11. **(b)** Equivalent weight in redox system is defined as $E = \frac{\text{Molar mass}}{\text{n-factor}}$

Here n-factor is the net change in oxidation number per formula unit of oxidising or reducing agent. In the present case-n-factor is 2 because equivalent weight is half of molecular weight. Also,

$MnSO_4 \longrightarrow \frac{1}{2}Mn_2O_3 \quad 1(+2 \longrightarrow +3)$

$MnSO_4 \longrightarrow MnO_2 \quad 2(+2 \longrightarrow +4)$

$MnSO_4 \longrightarrow MnO_4^- \quad 5(+2 \longrightarrow +7)$

$MnSO_4 \longrightarrow MnO_4^{2-} \quad 4(+2 \longrightarrow +6)$

Therefore, $MnSO_4$ converts to MnO_2.

12. **(c)** In $Ba(H_2PO_2)_2$, oxidation number of Ba is $+2$. Therefore,

$H_2PO_2^- : 2 \times (+1) + x + 2 \times (-2) = -1$

$\Rightarrow$ $x = +1$

13. **(a)** Lower the value of $E°$, stronger the reducing agent.

14. **(c)** Faraday's law of electrolysis is related to equivalent weight of electrolytes as ''The number of faraday's passed is equal to the number of gram equivalent of electrolytes discharged.''

15. **(c)** In KCN, the bonding between potassium ion and cyanide ion is ionic while carbon and nitrogen are covalently bonded in cyanide ion as:

Covalent bonds

$[K]^+[:C \equiv \dot{\dot{N}}:]^-$

Ionic bond

16. **(c)** N_2 has triple bond and each covalent bond is associated with one pair of electrons, therefore, six electrons are involved in forming bonds in N_2.

17. **(a)** $K_p = K_c(RT)^{\Delta n}$, $\Delta n = 2 - (1+1) = 0$

$\therefore$ $K_p = K_c(RT)°$ or $K_p = K_c$

18. **(b)** $K = \frac{[N_2O_4]}{[NO_2]} \frac{atm}{(atm)^2} = atm^{-1}$

19. **(d)** $pH = 14 - pOH = 14 - 3 = 11$

20. **(b)** HCl is strong acid. In its 0.1M solution, $[H^+] = 0.1M$ and hence, $pH = 1$ $NH_4Cl_{(aq)}$ hydrolyses in solution and give acidic solution which is less acidic than 1M HCl . NaCl is not hydrolysed in aqueous solutions. Its $pH = 7$ NaCN undergoes hydrolysis in solution to give alkaline solution. So that pH increases in the order, $HCl < NH_4Cl < NaCl < NaCN$

21. **(a)** The rate constant (k) of all chemical reaction depends on temperature.

$k = Ae^{-E_a/RT}$ where, A = Pre-exponential factor, E_a = Activation energy.

22. **(d)** Specific rate constant of reaction depends on temperature.

23. **(a)** The size of colloidal particles is of the order $0.1\text{m}\mu$ to $0.001\text{m}\mu$.

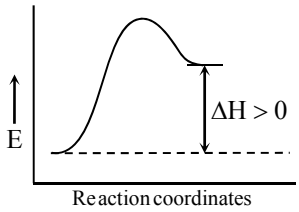
24. **(b)** $K_4[Fe(CN)_6]$ is most effective in the coagulation of gold-solution.

25. **(a)** $\Delta H = \Delta E + \Delta n_g RT$

$\Rightarrow \quad \Delta H - \Delta E = \Delta n_g RT = -3RT$

$= -3 \times 8.314 \times 298 = -7433 \text{ J} = -743 \text{ kJ}$

26. **(c)**



Minimum value of activation energy must be greater than ΔH.

27. **(b)** Isotones are atoms having same number of neutrons but different mass numbers.

$^{76}_{32}\text{Ge}$ (neutrons $= 44$) and $^{76}_{33}\text{As}$ (neutrons $= 44$)

28. **(a)** Isotonic means same number of neutrons.

29. **(c)**

$$\overset{sp}{N} \equiv \overset{1}{C} - \overset{2}{C}H = \overset{sp^2}{CH_2}$$

30. **(d)**

$$CH_2 = CH - \overset{O}{\overset{\|}{C}} - H \longleftrightarrow \overset{+}{C}H_2 - CH = \overset{O^-}{\overset{\|}{C}}H$$

$$\equiv \overset{\delta+}{C}H_2 = CH - \overset{O^{\delta-}}{\overset{\|}{C}} - H$$

31. **(c)** It is named by placing the functional class name "hydrazone" as a separate word after the name of the corresponding aldehyde or ketone. Here name of aldehyde is 'propanal'.

32. **(b)** The position of single heteroatom determines the numbering in a monocyclic compound.

33. **(b)** Methane is produced due to the decay of vegetables or animal organisms present in swamps and marsh, by the action of bacteria. Due to this method of formation, methane is also known as marsh gas.

34. **(d)** Unsaturated compounds which contain $C = C$ or $C \equiv C$, decolourises the purple colour of alkaline $KMnO_4$ solution.

$$CH_2 = CH_2 + \underset{\text{purple coloured}}{KMnO_4} \xrightarrow{HO^-}$$

$$\begin{matrix} CH_2 - OH \\ | \\ CH_2 - OH \end{matrix} + MnO_2 \downarrow$$

35. **(b)** $CH_3CH_2CH_2OH \xrightarrow{H_2SO_4} CH_3CH = CH_2 \xrightarrow{HI}$

36. **(b)** $C_2H_5I \xrightarrow{\text{Alc. KOH}} \underset{(X)}{CH_2 = CH_2} \xrightarrow{Br_2}$

$$\underset{(Y)}{\begin{matrix} CH_2 - CH_2 \\ | \quad | \\ Br \quad Br \end{matrix}} \xrightarrow{KCN} \underset{(Z)}{\begin{matrix} CH_2 - CH_2 \\ | \quad | \\ CN \quad CN \end{matrix}}$$

37. **(b)** 5–10% methyl and remaining ethanol is called methylated spirit. It is also known as denatured alcohol because it is unfit for drinking.

38. **(a)** 5% aqueous solution of phenol at room temperature is called as carbolic acid.

39. **(b)** $\underset{\text{2 propanone}}{CH_3\overset{O}{\overset{\|}{C}}CH_3}$

40. **(b)** CHOCHO Two aldehydic

41. **(a)**

$$R - \overset{O}{\overset{\|}{C}} \leftarrow OH \longleftrightarrow R - \overset{O^-}{\overset{|}{C}} - O \cdots\cdots H$$

It represents the acidic nature.

42. **(c)**

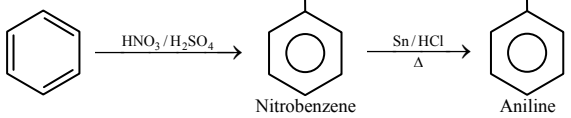
$$CH_3 - \overset{O}{\overset{\|}{C}} - CH_2 - \overset{O}{\overset{\|}{C}} - O - C_2H_5 \rightleftharpoons$$

Acetoacetic ester (keto form)

$$CH_3 - \overset{O}{\overset{\|}{C}} = CH - \overset{O}{\overset{\|}{C}} - O - C_2H_5$$

(enolic form)

43. **(b)**



Nitrobenzene Aniline

44. **(b)** The relative basic character of $1°$, $2°$ and $3°$ amines also depends upon the nature of the alkyl group.

R	Relative basic strength
$-CH_3$	$R_2NH > R - NH_2 > R_3N > NH_3$
$-C_2H_5$	$R_2NH > R - NH_2 > NH_3 > R_3N$
$-CHMe_2$	$R - NH_2 > NH_3 > R_2NH > R_3N$
$-CMe_3$	$NH_3 > R - NH_2 > R_2NH > R_3N$

45. **(b)** In addition polymerisation simple addition of monomer unit takes place without any loss of small molecules.

46. **(d)** 108 y^5

Explanation:

$Ca_3(PO_4)_2(s) \rightleftharpoons 3CA^{2+}(q) + 2PO_4^{3-}(aq)$

$3y \quad 2y$

Therefore, $K_{sp} = [Ca^{2+}]^3 \times [PO_4^{3-}]^2$

$= (3y)^3 \times (2y)^2$

$= 27\ y^3 \times 4y^2$

$= 108\ y^5$

47. **(b)** Acetoacetic acid ($pK_a = 3.58$)

For small concentration of buffering agent and for maximum buffer capacity

[Salt]/ [Acid] ≈ 1

i.e., $pH = pK_a$

48. **(c)** 4

$pOH = -\log [OH^-]$

$= -\log 10^{-10}$

$= 10 \log 10$

$= 10pH + pOH$

$= 14pH$

$= 14 - pOH$

$= 14 - 10$

$= 4$

49. **(b)**

NaX: Salt of weak acid, strong base.

$\Rightarrow \quad \alpha = (\sqrt{Kh/c})$

$= \sqrt{(Kw)/(KaC)}$

$= (10^{-14})/(10^{-5} \times 0.1)$

$= 10^{-4}$

$\Rightarrow$ % hydrolysis = 0.01%

50. **(c)** 12.65

When equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed, the hydroxide ion concentration is $\frac{(0.1 - 0.01)}{2}$

$= 0.045$ M

The pOH of the solution is $pOH = -\log [OH^-]$

$= -\log 0.045$

$= 1.35$

The pH of the solution is $pH = 14 - pOH$

$= 14 - 1.35$

$= 12.65$

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