PRACTICE SET-3

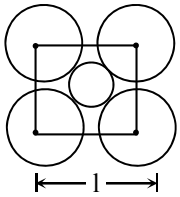
1. The sulphate of a metal M contains 9.87% of M. This sulphate is isomorphous with $ZnSO_4.7H_2O$. The atomic weight of M is:

a. 40.3 **b.** 36.3
c. 24.3 **d.** 11.3

2. 74.5 g of a metallic chloride contain 35.5 g of chlorine. The equivalent weight of the metal is:

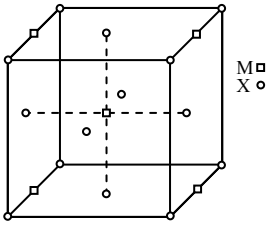
a. 19.5 **b.** 35.5
c. 39.0 **d.** 78.0

3. The packing efficiency of the two-dimensional square unit cell shown below is:



a. 39.27% **b.** 68.02%
c. 74.05% **d.** 78.54%

4. A compound M_pX_q has cubic close packing (ccp) arrangement of X. its unit cell structure is shown below. The empirical formula of the compound is:



a. MX **b.** MX_2
c. M_2X **d.** M_5X_{14}

5. Which of the following solutions has largest boiling point?

a. 0.1 M glucose **b.** 0.1 M NaCl
c. 0.1 M $BaCl_2$ **d.** 0.1 M urea

6. Which of the following solutions have lowest freezing point

a. 0.1 M NaCl **b.** 0.01 M NaCl
c. 1.0 M NaCl **d.** 0.001 M NaCl

7. When an ideal gas undergoes unrestrained expansion, no cooling occurs because the molecules

a. are above the inversion temperature.
b. exert no attractive forces on each other.
c. do work equal to loss in kinetic energy.
d. collide without loss of energy.

8. Equal weights of methane and hydrogen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by hydrogen is:

a. $\frac{1}{2}$ **b.** $\frac{8}{9}$ **c.** $\frac{1}{9}$ **d.** $\frac{16}{17}$

9. Ratio of masses of proton and electron is:

a. Infinite **b.** 1.8×10^3
c. 1.8 **d.** None of these

10. Splitting of signals is caused by:

a. Proton **b.** Neutron
c. Positron **d.** Electron

11. The number of moles of $KMnO_4$ that will needed to react with 1 mole of sulphite ion in acidic solution is:

a. $\frac{2}{5}$ **b.** $\frac{3}{5}$
c. $\frac{4}{5}$ **d.** 1

12. The number of moles of $KMnO_4$ that will be needed to react completely with 1 mole of ferrous oxalate in acidic medium is:

a. $\frac{2}{5}$ **b.** $\frac{3}{5}$ **c.** $\frac{4}{5}$ **d.** 1

13. The reaction, $\frac{1}{2}H_2(g) + AgCl(s)\ \ H^+(aq) + Cl^-(aq) + Ag(s)$ occurs in which the galvanic cell.

a. $Ag\,|\,AgCl(s)\,|\,KCl(Soln)\,|\,AgNO_3\,|\,Ag$
b. $Pt\,|\,H_2(g)\,|\,HCl(soln)\,|\,AgNO_3(soln)\,|\,Ag$
c. $Pt\,|\,H_2(g)\,|\,HCl(soln)\,|\,AgCl(s)Ag$
d. $Pt/H_2(g)\,|\,KCl(soln)\,|\,AgCl(s)Ag$

14. When a lead storage battery is discharged

a. SO_2 is evolved
b. lead is formed
c. lead sulphate is consumed
d. sulphuric acid is consumed

15. If a molecule MX_3 has zero dipole moment, the sigma bonding orbitals used by M (atomic number < 21) are:

a. pure p **b.** sp hybridised
c. sp^2 hybridised **d.** sp^3 hybridised

16. Among the following the linear molecule is:

a. CO_2 **b.** NO_2
c. SO_2 **d.** ClO_2

17. The ratio of K_p / K_c for the reaction $CO(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO_2(g)$ is:

a. 1 **b.** RT

c. $(RT)^{1/2}$ **d.** $(RT)^{-1/2}$

18. For the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$; K_p / K_c is equal to:

a. RT **b.** 0

c. $(RT)^{-1}$ **d.** 1

19. If the hydrogen ion concentration of a given solution is 5.5×10^{-3} mol litre^{-1}, the pH of the solution will be:

a. 2.26 **b.** 3.40

c. 3.75 **d.** 2.76

20. Henderson's equation is $pH = pK_a + \log \frac{[salt]}{[acid]}$. If the acid gets half neutralised the value of pH will be: $[pK_a = 4.30]$

a. 4.3 **b.** 2.15

c. 8.60 **d.** 7

21. The rate constant for the reaction, $2N_2O_5 \longrightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} s^{-1}$. If the rate is 2.40×10^{-5} mol $L^{-1}s^{-1}$, then the concentration of N_2O_5 (in mol L^{-1}) is:

a. 1.4 **b.** 1.2

c. 0.04 **d.** 0.8

22. If I is the intensity of absorbed light and C is the concentration of AB for the photochemical process. $AB + h\nu \longrightarrow AB^*$, the rate of formation of AB^* is directly proportional to:

a. C **b.** I

c. I^2 **d.** C·I

23. Example of intrinsic colloid is:

a. Glue **b.** Sulphur

c. Fe **d.** As_2S_3

24. Colloidal solution of arsenious sulphide can be prepared by:

a. Electrodispersion method

b. Peptisation

c. Double decomposition

d. Hydrolysis]

25. Which of the following statements is false?

a. Work is a state function.

b. Temperature is a state function.

c. Change in the state is completely defined when the initial and final states are specified.

d. Work appears at the boundary of the system.

26. One mole of a non-ideal gas undergoes a change of state (2.0 atm, 3.0 L, 95 K) $\longrightarrow$ (4.0 atm, 5.0 L, 245 K) with a change in internal energy, $\Delta E = 30.0 L - atm$. The change in enthalpy (ΔH) of the process in L-atm is:

a. 40.0

b. 42.0

c. 44.0

d. not defined, because pressure is not constant

27. The half life periods of four isotopes are given:

I = 6.7 years II = 8000 years

III = 5760 years IV = 2.35×10^5 years

a. I **b.** II

c. III **d.** IV

28. How many α and β particles are emitted in the transformation $^{238}_{92}U \longrightarrow {}^{234}_{92}U$

a. 1, 1 **b.** 1, 0

c. 1, 2 **d.** 2, 1

29. Amongst the following, the most basic compound is:

a. benzylamine **b.** aniline

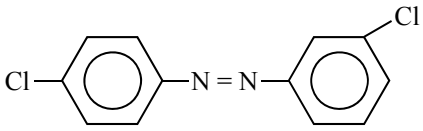
c. acetanilide **d.** p-nittroaniline

30. The hybridisation of carbon atoms in C—C single bond $H-C \equiv C-C-CH=CH_2$ is

a. $sp^3 - sp^3$ **b.** $sp^2 - sp^3$

c. $sp - sp^3$ **d.** $sp^3 - sp$

31. Assign the IUPAC name for the following compound.



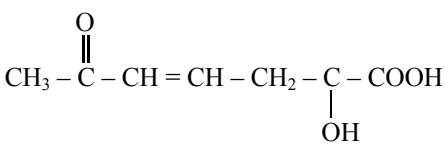
a. (3-chlorophenyl)(4-chlorophenyl) diazene)

b. 3,4-bis(chlorophenyl) diazene

c. (4-chlorophenyl (3-chlorophenyl) diazene

d. 3,4-dichloroazobenzene

32. What is the IUPAC name of the following compound?



a. 2-hydroxy-6-oxohept-4-enoic acid
b. 2-hydroxy-6-ketohept-4-enoic acid
c. 5-acetyl-2-hydroxypent-4-enoic acid
d. 2-hydroxy-6-oxoheptanoic acid

33. When propyne is treated with aqueous H_2SO_4 in presence of $HgSO_4$, the major product is?
a. propanal
b. propyl hydrogen sulphate
c. acetone
d. propanol

34. Which of the following compounds does not dissolve in conc. H_2SO_4 even on warming?
a. Ethylene **b.** Benzene
c. Hexane **d.** Aniline

35. Chloroform on heating with silver powder gives:
a. Acetylene **b.** Methane
c. Ethylene **d.** Nitroethane

36. If methyl bromide and ethyl bromide are mixed in equal proportion and mixture is treated with sodium, the number of possible organic products is:
a. 1 **b.** 2 **c.** 3 **d.** 4

37. Ethyl alcohol is industrially prepared from ethylene by:
a. Permanganate oxidation
b. Catalytic reduction
c. Absorbing in H_2SO_4 followed by hydrolysis
d. Fermentation

38. Propene, $CH_3-CH=CH_2$ can be converted to 1-propanol by oxidation. Which set of reagents among the following is ideal to effect the conversion?
a. Alkaline $KMnO_4$
b. B_2H_6 and alkaline H_2O_2
c. O_3 / Zn dust
d. $OsO_4 / CH_4, Cl_2$

39. Compound which gives acetone on ozonolysis?
a. $CH_3-CH=CH-CH_3$ **b.** $(CH_3)_2C=C(CH_3)_2$
c. $C_6H_5CH=CH_2$ **d.** $CH_3CH=CH_2$

40. $CH_3-\underset{\underset{O}{\|}}{C}-CH_2-COOC_2H_5 \xrightarrow[H_2O]{NaOH} A,$
Product 'A' in the reaction is:
a. CH_3COOH **b.** C_2H_5OH
c. CH_3COCH_3 **d.** C_2H_5CHO

41. Number of oxygen atoms in a acetamide molecule is:
a. 1 **b.** 2
c. 3 **d.** 4

42. Urea is:
a. Monoacidic base **b.** Diacidic base
c. Neutral **d.** Amphoteric

43. Melting points are normally the highest for
a. Tertiary amides **b.** Secondary amides
c. Primary amides **d.** Amines

44. Amines behave as:
a. Lewis acids **b.** Lewis bases
c. Aprotic acids **d.** Amphoteric compounds

45. The common acid used in the manufacture of rayon and plastics is:
a. Methanoic acid **b.** Ethanoic acid
c. Propanoic acid **d.** Butanoic acid

46. Solvays process is used for the manufacture of :
a. NaOH **b.** $(Na_2CO_3.\ 10H_2O)$
c. K_2CO_3 **d.** Na_2O_2

47. Alkali metals give a _____ when dissolved in liquid ammonia
a. Deep blue solution **b.** Colourless
c. Red colour **d.** None of the Above

48. What are Oxo-Acids?
a. Acid containing Oxygen
b. Acid containing Sulphur
c. Acid containing Carbon
d. None of the Above

49. In curing cement plasters, water is sprinkled from time to time. This helps in
a. Converting sand into silicic acid
b. Keeping it cool
c. Developing interlocking needle like crystals of hydrated silicates
d. Hydrating sand and gravel mixed with cement.

50. The substance not likely to contain CaCO3 is
a. Dolomite **b.** A marble statue
c. Calcined gypsum **d.** Sea shells.

Answers and Solutions

1. **(c)** As the given sulphate is isomorphous with $ZnSO_4.7H_2O$ its formula would be $MSO_4.7H_2O$ .m is the atomic weight of M, molecular weight of $MSO_4.7H_2O = m+32+64+126 = m+222$

Hence % of $M = \frac{m}{m+222} \times 100 = 9.87$ (given) or

$100m = 9.87m + 222 \times 9.87$ or $90.13m = 222 \times 9.87$

or $m = \frac{222 \times 9.87}{90.13} = 24.3$.

2. **(c)** wt. of metallic chloride = 74.5

wt. of chlorine = 35.5

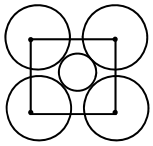
$\therefore$ wt. of metal $= 74.5 - 35.5 = 39$

Equivalent weight of metal:

$= \frac{\text{weight of metal}}{\text{weight of chlorine}} \times 35.5 = \frac{39}{35.5} \times 35.5 = 39$

3. **(d)** Contribution of circle from corner of square $= \frac{1}{4}$

$\Rightarrow$ Effective number of circle per square



$= \frac{1}{4} \times 4 + 1(\text{at centre}) = 2$

$\Rightarrow$ Area occupied by circle $= 2\pi r^2; r =$ radius.

Also, diagonal of square $4r = \sqrt{2}$ L, where L, = side of square.

$\Rightarrow$ Packing fraction $= \frac{\text{Area occupied by circles}}{\text{Area of square}}$

$= \frac{2\pi r^2}{L^2} = \frac{2\pi r^2}{8r^2} = \frac{\pi}{4} = 0.785$

$\Rightarrow$ % Packing efficiency

= 78.5 %.

4. **(b)** Contribution of atom from the edge centre is ¼. Therefore, number of

$M = \frac{1}{4} \times 4$ (from edge centre) + 1 (from body centre) $= 2$

Number of $X = \frac{1}{8} \times 8$ (from corners) $+ \frac{1}{2} \times 6$ (from corners) = 4

$\Rightarrow$ Empirical formula $= M_2X_4 = MX_2$

5. **(c)** ΔT_b will depend upon the number of particles given by the solution in the solution (concentration is same).

(a) 0.1 M glucose (0.1 mole particles)

(b) 0.1 M NaCl ($NaCl \rightleftharpoons Na^+ + Cl^-$; 0.2 mole particles)

(c) 0.1 $BaCl_2$ ($BaCl_2 \rightleftharpoons Ba^{2+} + 2Cl^-$; 0.3 mole particles)

(d) 0.3 M urea (0.1 mole particles).

ΔT_b will be largest for C and, therefore, boiling point will be larges.

6. **(c)** ΔT_f depends upon concentration because solution is the same. Therefore, 0.1 M NaCl will cause maximum depression in freezing point and the freezing point of 1.0 M NaCl solution will be lowest.

7. **(b)** According to postulates of kinetic theory, there is no intermolecular attractions or repulsions between the molecules of ideal gases.

8. **(b)** Let x grams of each hydrogen and methane are mixed,

Moles of $H_2 = \frac{x}{2}$

Moles of $CH_4 = \frac{x}{16}$

$\Rightarrow$ Mole-fraction of $H_2 = \frac{\frac{x}{2}}{\frac{x}{2} + \frac{x}{16}} = \frac{8}{9}$

$\Rightarrow$ $\frac{\text{Partial pressure of } H_2}{\text{Total pressure}} = \text{mole} - \text{fraction of } H_2 = \frac{8}{9}$

9. **(b)** $m_p / m_e \simeq 1837 \simeq 1.8 \times 10^3$.

10. **(a)** Splitting of signals is caused by protons attached to adjacent carbon provided these are not equivalent to the absorbing proton.

11. **(a)** The balanced chemical reaction is:

$2MnO_4^- + 5SO_3^{2-} + 6H^+ \longrightarrow 2Mn^{2+} + 5SCO_4^{2-} + 3H_2O$

$\because$ 5 moles SO_3^{2-} reacts with 2 mole of $KMnO_4$

$\therefore$ 1 mole of SO_3^{2-} require $\frac{2}{5}$ moles of $KMnO_4$.

12. **(b)** The balanced redox reaction is:

$3MnO_4^- + 5FeC_2O_4 + 24H^+ \longrightarrow 3Mn^{2+} + 5Fe^{3+}$

$+10CO_2 + 12H_2O$

$\because$ 5 moles FeC_2O_4 require 3 mole of $KMnO_4$

$\therefore$ 1 mole of FeC_2O_4 will require $\frac{3}{5}$ mole of $KMnO_4$.

13. **(c)** In a galavanic cell, oxidation occurs in the left hand electrode chamber and reduction in right hand electrode chamber. In the following combination of cell.

$Pt \mid H_2(g) \mid HCl(soln) \parallel AgCl(s) \mid Ag(s)$

The cell reactions are:

At anode $\frac{1}{2}H_2(g) \longrightarrow H^+ + e^-$

At cathode $AgCl(s) + e^- \longrightarrow Ag + Cl^-$

Net: $\underline{\frac{1}{2}H_2(g) + AgCl(s) \longrightarrow H^+ + Ag(s) + Cl^-}$

14. **(d)** In a lead storage battery, sulphuric acid is consumed as: $Pb + PbO_2 + 2H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O$

15. **(c)** For non-polar MX_3, it must have triangular planar arrangement, i.e., there should be sp^2 hybridisation around M.

16. **(a)** CO_2 is a linear molecule because of sp hybridisation around carbon atom.

17. **(d)** $K_p = K_c(RT)^{\Delta n}$,

Here $\Delta n = 2 - \left(1 + \frac{1}{2}\right) = -\frac{1}{2}$

$\therefore \quad \frac{K_p}{K_c} = (RT)^{1/2}$

18. **(d)** $K_p = K_c(RT)^{\Delta n}$

Here $\Delta n = 2 - (1+1) = 0 \qquad \therefore \quad \frac{K_p}{K_c} = 1$

19. **(a)** $[H^+] = 5.5 \times 10^{-3}$ mole/litre

$pH = -\log [H^+]; \quad pH = -\log [5.5 \times 10^{-3}]; \quad pH = 2.26$

20. **(a)** $pH = pK_a + \log \frac{[Salt]}{[Acid]}$

$pH = 4.3 + \log \frac{\frac{1}{2}}{\frac{1}{2}} = 4.3 + \log 1; \quad pH = 4.3 + 0 = 4.3$

21. **(d)** The unit of rate constant (t^{-1}) indicating that the decomposition reaction following first order kinetics.

$\Rightarrow \quad Rate = k[N_2O_5]$

$\Rightarrow \quad [N_2O_5] = \frac{Rate}{k} = \frac{2.40 \times 10^{-5}}{3 \times 10^{-5}} = 0.80 \text{ M}$

22. **(d)** Rate will be directly proportional to both concentration and intensity, i.e., rate of formation of $AB^* \propto$ C.I.

23. **(a)** On shaking with the dispersion medium, colloids directly form the colloidal sol. Hence they are called intrinsic colloids. i.e., glue.

24. **(c)** Arsenious sulphide can be prepared by double decomposition.

$As_2O_3 + 3H_2S \longrightarrow As_2S_3 + 3H_2O$

25. **(a)** Work is not a state-function, it depends on path followed.

26. **(c)** $\Delta H = \Delta U + \Delta(pV) = 30 + 2(5-3) + 5(4-2) = 44$ L atm.

27. **(d)** Longer the half life period, more will be the stability of the element.

28. **(c)** $^{238}_{92}U \longrightarrow {}^{234}_{92}U + x\,{}^{4}_{2}He + y\,{}^{0}_{-1}e$

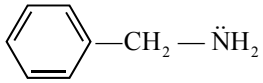
$238 = 234 + 4x + 0$

or $4x = 4$ or $x = 1$

$\Rightarrow \quad 92 = 92 + 2x - y$

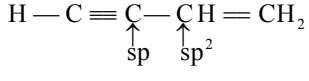
$92 = 92 + 2 \times 1 - y$

or $y = 2$

29. **(a)** 

benzyl amine

Lone pair is not involved in resonance, most basic. In all other cases, lone-pair of nitrogen is involved in resonance, less basis.

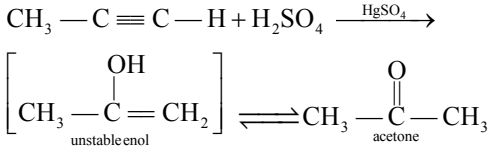
30. **(d)** 

31. **(a)** This compound is named as the derivative of 'diazene'.

32. **(a)** The principal functional group is –COOH. The parent hydride is 'heptane'.

33. **(c)** Alkynes undergo Markownikoff's addition of water in presence of

$H_2SO_4 / HgSO_4$



34. **(c)** Ethylene absorbs H_2SO_4 forming $CH_3—CH_2OSO_3H$ and dissolve.

Benzene with warm H_2SO_4, undergo sulphonation, and dissolve.

Hexane, a hydrophobic molecule, does not react with H_2SO_4, remains insoluble.

Aniline, with H_2SO_4, forms anilinium sulphate salt and dissolve.

35. **(a)** $CHCl_3 + 6Ag + Cl_3CH \longrightarrow HC \equiv CH + 6AgCl$

36. **(c)** (i) $2CH_3Br + 2Na \longrightarrow CH_3CH_3$ (Ethane)

(ii) $2CH_3CH_2Br + 2Na \longrightarrow C_4H_{10}$ (Butane)

(iii) $CH_3Br + C_2H_5Br + 2Na \longrightarrow C_3H_8$ (Propane)

37. **(c)** $CH_2 = CH_2 \xrightarrow{H_2SO_4} CH_3 - CH_2 - HSO_4 \xrightarrow{\text{Hydrolysis}} CH_3CH_2 - OH + H_2SO_4$

38. **(b)** Hydroboration oxidation (Industrial preparation of alcohol).

$$3CH_3CH = CH_2 + \frac{1}{2}B_2H_6 \xrightarrow[\text{ether}]{\text{Dry}} (CH_3CH_2CH_3)_3B$$

$$(CH_3CH_2CH_3)_3B \xrightarrow{H_2O_2} 3CH_3CH_2CH_2 - OH$$

39. **(b)** $(CH_3)_2C = C(CH_3)_2 \xrightarrow{O_3} 2CH_3 - CO - CH_3$

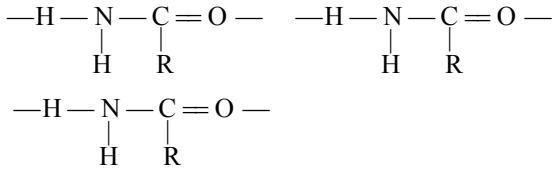
40. **(c)** Ketonic hydrolysis:

$$CH_3 - CO - CH_2COOC_2H_5 \xrightarrow[H_2O]{NaOH} CH_3COCH_3 + C_2H_5OH + CO_2$$

41. **(a)** Formula of Acetamide is CH_3CONH_2 which consist single oxygen atom.

42. **(a)** Urea behaves as a monoacidic base and react with nitric acid and form sparingly soluble nitrate.

43. **(c)** The higher boiling points of amide is because of Intermolecular hydrogen bonding.



Due to intermolecular hydrogen bonding they have high boiling point than amine and amongst amide the order of Boiling point are:

Primary > Secondary > Tertiary

This is because of alkyl group by which the carbonyl oxygen do not form the hydrogen bond (other molecule) so primary amide have high boiling point and tertiary Amides does not have to form bond with O of other amide and have least B.P

44. **(b)** In amines nitrogen has a lone pair of e^-. It can donate a election pair. So, amines behave as a Lewis base.

45. **(b)** Ethanoic acid is used in the manufacture of resin and plastics.

46. **(b)** ($Na_2CO_3 . 10H_2O$)

The Solvay process or ammonia soda process is used for the manufacture of sodium carbonate ($Na_2CO_3 . 10H_2O$).

47. **(a)** Deep blue solution

When an alkali metal is dissolved in liquid ammonia, it results in the formation of a deep blue coloured solution. The ammoniated electrons absorb energy corresponding to a red region of visible light. Therefore, the transmitted light is blue in colour.

48. **(a)** Acid containing Oxygen

An oxyacid, oxoacid, or ternary acid is an acid that contains oxygen. Specifically, it is a compound that contains hydrogen, oxygen, and at least one other element, with at least one hydrogen atom bond to oxygen that can dissociate to produce the H+ cation and the anion of the acid. e.g., carbonic acid, H_2CO_3 ($OC(OH)_2$; sulphuric acid, H_2SO_4 ($O_2S(OH)_2$).

49. **(c)** Developing interlocking needle like crystals of hydrated silicates

Water develops interlocking needle ¬like crystals of hydrated silicates. The reactions involved are the hydration of calcium aluminates and calcium silicates which change into their colloidal gels.

At the same time, some calcium hydroxide and aluminium hydroxides are formed as precipitates due to hydrolysis. Calcium hydroxide binds the particles of calcium silicate together while aluminium hydroxide fills the interstices rendering the mass impervious

50. **(c)** Calcined gypsum

The composition of gypsum is $CaSO_4 \cdot 2H_2O$. It does not have $CaCO_3$

❑❑❑