PRACTICE SET-5

1. 1.24 g *P* is present in 2.2 g?

a. P_4S_3 **b.** P_2S_2

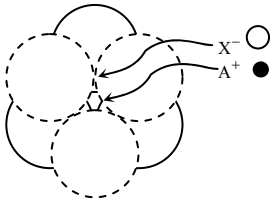
c. PS_2 **d.** P_2S_4

2. The atomic weights of two elements A and B are 40 and 80 respectively. If *x* g of A contains *y* atoms, how many atoms are present in 2*x* g of B?

a. $\frac{y}{2}$ **b.** $\frac{y}{4}$

c. y **d.** $2y$

3. The arrangement of X^- ions around A^+ ion in solid AX is given in the figure (not drawn to scale). If the radius of X^- is 250 pm, the radius of A^+ is:



a. 104 pm **b.** 125 pm

c. 183 pm **d.** 57 pm

4. CsCl crystallises in body centred cubic lattice. If 'a' its edge length, then which of the following expressions is correct?

a. $r_{Cs^+} + r_{Cl^-} = 3a$ **b.** $r_{Cs^+} + r_{Cl^-} = \frac{3a}{2}$

c. $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}a$ **d.** $r_{Cs^+} + r_{Cl^-} = \sqrt{3}a$

5. Two solutions A and B are separated by a semi-permeable membrane. If the solvent flows from A to B, then

a. A is more concentrated than B.

b. A is less concentrated than B.

c. Both A and B have the same concentration.

d. Both A and B get diluted.

6. The molal elevation constant is the ratio of elevation in boiling point to:

a. Molarity

b. Boiling point of pure liquid

c. Mole fraction of solute

d. Molality of solution

7. An atom has 26 electrons and its atomic weight is 56. The number of neutrons in the nucleus of the atom will be:

a. 26 **b.** 30

c. 36 **d.** 56

8. The most probable radius (in pm) for finding the electron in He^+ is:

a. 0.0 **b.** 52.9

c. 26.5 **d.** 105.8

9. Among the following, the species in which the oxidation number of an element is + 6

a. MnO_4^- **b.** $Cr(CN)_6^{3-}$

c. NiF_6^{2-} **d.** CrO_2Cl_2

10. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is:

a. 40 mL **b.** 20 mL

c. 10 mL **d.** 4 mL

11. The standard reduction potential values of three metallic cations, X, Y, Z are 0.52 V, – 3.03 V and – 1.18 V respectively. The order of reducing power of the corresponding metals is:

a. Y>Z>X **b.** X>Y>Z

c. Z>Y>X **d.** Z>X>Y

12. The gas X at 1 atm is bubbled through a solution containing a mixture of 1 M Y^- and 1 M Z^- at 25°C. If the order of reduction potential is Z < Y > X, then

a. Y will oxidise X and not Z

b. Y will oxidise Z and not X

c. Y will oxidise both X and Z

d. Y will reduce both X and Z

13. For the electrochemical cell,

$(M/M^+)\,||\,(X^-\,|\,X), E°(M^+/M) = 0.44V$ and

$E°(X/X^-) = 0.33V$. From this data one can deduce that

a. $M + X \longrightarrow M^+ + X^-$ is the spontaneous reaction

b. $M^+ + X \longrightarrow M + X$ is the spontaneous reaction

c. $E_{cell} = 0.77V$

d. $E_{cell} = -0.77V$

14. 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

15. Which one among the following does not have the hydrogen bond?

a. Phenol **b.** Liquid NH_3

c. Water **d.** HCl

16. On hybridisation of one s and one p-orbital get:

a. two mutually perpendicular orbitals

b. two orbitals at $180°$

c. four orbitals directed tetrahedrally

d. three orbitals in a plane

17. The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is 64. If the volume of the container is reduced to half of its original volume, the value of equilibrium constant will be:

a. 64 **b.** $\frac{1}{64}$

c. 32 **d.** 16

18. For the reaction $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$ the value of K_c at $250°C$ is 26. The value of K_p at the temperature will be:

a. 0.61 **b.** 0.52

c. 0.83 **d.** 0.46

19. The solubility product constant K_{sp} of $Mg(OH)_2$ is 9.0×10^{-12}. If a solution is 0.010 M with respect to Mg^{2+} ion, what is the maximum hydroxide ion concentration which could be present without causing the precipitation of $Mg(OH)_2$.

a. 1.5×10^{-7} M **b.** 3.0×10^{-7} M

c. 1.5×10^{-5} M **d.** 3.0×10^{-5} M

20. If the K_b value in the hydrolysis reaction $B^+ + H_2O \rightleftharpoons BOH + H^+$ c is 1.0×10^{-6}, then the hydrolysis constant of the salt would be:

a. 1.0×10^{-6} **b.** 1.0×10^{-7}

c. 1.0×10^{-8} **d.** 1.0×10^{-9}

21. The mechanism for the reaction is given below $2P + Q \rightarrow S + T$ $P + Q \rightarrow R + S$ (slow) $P + R \rightarrow T$ (fast). The rate law expression for the reaction is:

a. $r = k[P]^2[Q]$

b. $r = k[P][Q]$

c. $r = k[A][R]$

d. $r = k[P]^2$ 1.73×10^{-5} M min^{-1}

22. Which one of the following statements is incorrect about order of reaction?

a. Order of reaction is determined experimentally.

b. Order of reaction is equal to sum of the power of concentration terms in differential rate law.

c. It is not affected with stoichiometric coefficient of the reactants.

d. Order cannot be fractional.

23. Commercial detergents mainly contain:

a. RCOONa **b.** RONa

c. RSNa **d.** $ROSO_2Na$

24. Which one of the following is used for reviving the exhausted permutit?

a. HCl solution **b.** 10% $CaCl_2$ solution

c. 10% $MgCl_2$ solution **d.** 10% NaCl solution

25. $\Delta H_{vap} = 30$ kJ / mol and $\Delta S_{vap} = 75 Jmol^{-1}K^{-1}$. Find temperature of vapour, at one atmosphere pressure?

a. 400 K **b.** 350 K

c. 298 K **d.** 250 K

26. 2 moles of an ideal gas expanded isothermally and reversibly from 1 L to 10 L at 300 K. what is the enthalpy change?

a. 4.98 kJ **b.** 11.47 kJ

c. –11.47 kJ **d.** 0 kJ

27. If uranium (mass number 238 and atomic number 92) emits an α – particle, the product has mass number and atomic number.

a. 236 and 92 **b.** 234 and 90

c. 238 and 90 **d.** 236 and 90

28. An isotope of Ge $^{76}_{32}$ is:

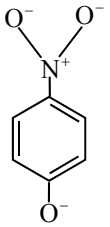
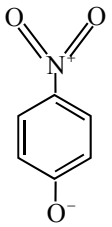
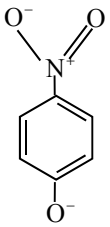
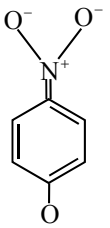
a. Ge $^{76}_{32}$ **b.** As $^{77}_{33}$ **c.** Se $^{77}_{34}$ **d.** Se $^{78}_{34}$

29. Among the following compounds, the strongest acid is:

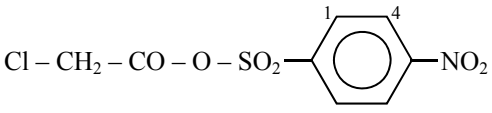
a. $HC \equiv CH$ **b.** C_6H_6

c. C_2H_6 **d.** CH_3OH

30. The most unlikely representation of resonance structures of p-nitrophenoxide ion is:

a.  **b.**  **c.**  **d.** 

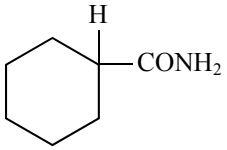
31. The IUPAC name of the following compound.



is?

a. chloroacetic 4-nitrobenzenesulphonic anhydride
b. 4-nitrobenzenesulphonicchloroethanoic anhydride
c. chloroethanoic 4-nitrobenzenesulphonic anhydride
d. chloroethanoic nitrobenzenesulphonic anhydride.

32. Write the IUPAC name of the compound.



a. Cyclohexanamide
b. Carbamoyl benzene
c. Cyclohexane carboxamide
d. Benzamide

33. The highest boiling point is expected for?
a. iso-butane
b. n-octane
c. 2, 2, 3, 3- tetramethyl butane
d. n-butane

34. The number of structural and configurational isomers of a bromo compound, C_5H_9Br, formed by the addition of HBr to 2- pentyne respectively, are?
a. 1 and 2 **b.** 2 and 4
c. 4 and 2 **d.** 2 and 1

35. Chloroform on treatment with conc. HNO_3 gives:
a. Nitromethane **b.** Picric acid
c. Chloropicrin **d.** Nitroethane

36. Which chlorobenzene is heated with conc. NaOH solution at about 575 K under high pressure, the product is:
a. Phenol
b. n-Chlorophenol
c. o-and p-Chlorophenol
d. Benzene

37. Coconut oil upon alkaline hydrolysis gives:
a. Glycol **b.** Alcohol
c. Glycerol **d.** Ethylene oxide

38. In the commercial manufacture of ethyl alcohol from starchy substances by fermentation method, which enzymes stepwise complete the fermentation reaction?
a. Diastase, maltase and zymase
b. Maltase, zymase and invertase
c. Diastase, zymase and lactase
d. Diastase, invertase and zymase

39. Dry heating of calcium acetate gives:
a. Acetaldehyde **b.** Ethane
c. Acetic acid **d.** Acetone

40. Which of the following compound gives a ketone with Grignard reagent?
a. Formaldehyde **b.** Ethyl alcohol
c. Methyl cyanide **d.** Methyl iodide

41. Carbolic acid is:
a. C_6H_5CHO **b.** C_6H_6
c. C_6H_5COOH **d.** C_6H_5OH

42. The most acidic of the following is:
a. $ClCH_2COOH$ **b.** C_6H_5COOH
c. CD_3COOH **d.** CH_3CH_2COOH

43. A nitrogen containing organic compound on heating with chloroform and alcoholic KOH, evolved very unpleasant smelling vapour. The compound could be:
a. N, N-dimethyl amine
b. Nitrobenzene
c. Aniline
d. Benzamide

44. The reaction between a primary amine, chloroform and few drops of alcoholic KOH is known as:
a. Cannizzaro reaction
b. Carbylamine reaction
c. Wurtz's reaction
d. Reimer–Tiemann reaction

45. Glucose gives many reactions of aldehyde, because
a. It is hydrolysed to acetaldehyde.
b. It is a polyhydroxy ketone.
c. It is a cyclic aldehyde.
d. It is a hemiacetal in equilibrium with its aldehyde form in solution.

46. The basic strength of which hydroxide is maximum
a. LiOH **b.** NaOH
c. $Ca(OH)_2$ d. KOH.

47. The hydration energy of Mg^{2+} is larger than that of
a. $A1^{3+}$ **b.** Na^{+}
c. Be^{26} d. Mg^{3+}

48. Milk of lime reacts with chlorine to form _____, a constituent of bleaching powder.
a. $Ca(OCI)_2$ **b.** $Ca(ClO_2)_2$
c. $Ca(ClO_3)_2$ **d.** $Ca(ClO_4)_2$

49. What happens when Calcium carbonate is heated to 1200 K?

a. Carbon Monoxide

b. Calcium hydroxide

c. Calcium Oxide

d. Both (2) and (3) are correct

50. The salt that is added to table salt to make it flow freely in rainy season is

a. KCl **b.** KI

c. $Ca_3(PO_4)_2$ **d.** Na_3PO_4

Answers and Solutions

1. **(a)** Choice **(a)** is P_4S_3

$\because$ $\frac{31\times 4}{(124)}$ gm P is present in 220 gm P_4S_3

$\therefore$ 1.24 gm P is present in

$= \frac{220}{124}\times 1.24 = 2.2\text{gm}$

2. **(c)** Number of moles of $A = \frac{x}{40}$

Number of atoms of A $A = \frac{x}{40}\times$ Avogadro no. $= y$ (say)

or $x = \frac{40y}{\text{Avogadro no.}}$

Number of moles of B $B = \frac{2x}{80}$

Number of atoms of $B = \frac{2x}{80}\times$ Av. no.

$= \frac{2}{80}\times\frac{40y}{\text{Av. no.}}\times\text{Av. no.} = y$

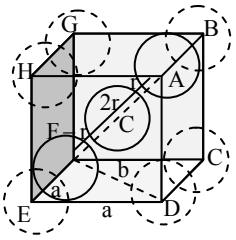
3. **(a)** Given arrangement represents octahedral void and for this

$\frac{r_+(\text{cation})}{r_-(\text{cation})} = 0.414 \quad \frac{r(A^+)}{r(X^-)} = 0.414$

$r(A^+) = 0.414\times r(X^-)$

$= 0.414\times 250\text{ pm} = 103.5\text{pm}\approx 104\text{ pm}$

4. **(c)** In $CsCl, Cl^-$ lies at corners of simple cube and Cs^+ at the body centre. Hence, along the body diagonal, Cs^+ and Cl^- touch each other so $r_{Cs^+} + r_{Cl^-} = 2r$



Calculation of r

In ΔEDF,

Body centred cubic unit cell

$FD = b = \sqrt{a^2 + a^2} = \sqrt{2a}$

In Δ AFD,

$c^2 = a^2 + b^2 = a^2 + (\sqrt{2a})^2 = a^2 + 2a^2$

$c^2 = 3a^2 \qquad c = \sqrt{3a}$

As Δ AFD is an equilateral triangle.

$\therefore$ $\sqrt{3a} = 4r \Rightarrow r = \frac{\sqrt{3a}}{4}$

Hence, $r_{Cs^+} + r_{Cl} = 2r = 2\times\frac{\sqrt{3}}{4}a = \frac{\sqrt{3}}{2}a$

5. **(b)** Solvent moves from higher concentration of solvent (less concentrated solution) to lower concentration of solvent (highly concentrated solution) due to osmosis.

6. **(d)** $\Delta T_b = K_b m$

$\therefore$ $K_b = \Delta T_b / m$

7. **(b)** $_{26}X^{56}$ $A = P + N = Z + N = E + N$

$N = A - E = 56 - 26 = 30$

8. **(c)** Most probable radius $= a_0 / Z$

Where $a_0 = 52.9$ pm. For helium ion, $Z = 2$.

$r_{mp} = \frac{52.9}{2} = 26.45\,\text{pm}.$

9. **(d)** In MnO_4^-, oxidation sate of Mn is $+7$

In $Cr(CN)_6^{3-}$, oxidation sate of Cr is $+3$

In NiF_6^{2-}, Ni is in $+4$ oxidation sate.

In CrO_2Cl_2, oxidation sate of Cr is $+6$.

10. **(a)** Oxalic acid dehydrate $H_2C_2O_4.2H_2O$: mw $= 126$ is a dibasic acid, hence

Equivalent weight $= 63$

$\Rightarrow$ Normality $= \frac{6.3}{63}\times\frac{1000}{250} = 0.4$ N

$\Rightarrow$ $N_1V_1 = N_2V_2$

$\Rightarrow \quad 0.1 \times V_1 = 0.4 \times 10$

Hence, $V_1 = 40\text{mL}$.

11. **(a)** Lower the value of $E°$ stronger the reducing agent. Reducing power

$Y(E° = -3.03V) > Z(E° = -1.18V) > X(E° = 0.52\,V)$.

12. **(a)** Higher the value of reduction potential, stronger the oxidising agent.

$\because \quad E° : Z < Y > X$

$\Rightarrow$ Y will oxidise X but not Z.

13. **(b)** The spontaneous cell reaction is

$X^- + M^+ \longrightarrow M + X \; E° = 0.11V$

14. **(b)** In LiCl, NaCl and KCl, anions are same. Cations have same charge but different size. Smaller cations are more heavily hydrated in aqueous solution giving larger hydrated radius and thus smaller ionic speeds and equivalent conductance.

$\Rightarrow$ Equivalent conductance: $KCl > NaCl > LiCl$

15. **(d)** HC1 does not from hydrogen bond. For formation of hydrogen bond at least one hydrogen atom must be bonded to one of the three most electronegative atom O, N and F.

16. **(b)** Hydridisation of one 's' and one 'p' orbtials gives two sp hybrid orbitals oriented linearly at 180° $s + p \longrightarrow 2sp$ hybrid orbitals.

17. **(a)** Change in volume of container will change the concentrations of the reaction mixture but the equilibrium constant remains unchanged.

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

$\therefore \quad K_p = 26 \times (0.082 \times 523)^{-1} = \dfrac{26 \times 1}{0.082 \times 523} = 0.61$

19. **(d)** $\underset{K_{sp}}{Mg(OH)_2} \rightleftharpoons \underset{S}{Mg^{++}} + \underset{(2S)^2}{2OH^-}$

$K_{sp} = S \times 4S^2$

$\dfrac{K_{sp}}{S \times 4} = S^2 = \dfrac{9 \times 10^{-12}}{.010 \times 4} = 2.25 \times 10^{-10}$

$S = \sqrt{2.25 \times 10^{-10}} = 1.5 \times 10^{-5}$ m/l

20. **(c)** For hydrolysis of B^+;

$K_H = \dfrac{K_w}{K_b} = \dfrac{10^{-14}}{10^{-6}} = 10^{-8}$.

21. **(b)** The rate law expression for the reaction is $r = k[P][Q]$.

22. **(d)** Order of a reaction can take any real value, i.e., negative, integer, fraction, etc.

23. **(a)** Commercial detergents mainly contain salts of higher fatty acids.

24. **(d)** 10% NaCl solution is used for reviving the exhaust permutit.

25. **(a)** $T = \dfrac{\Delta H_{vap}}{\Delta S_{vap}} = \dfrac{30,000}{75} = 400\text{ K}$

26. **(d)** In case of reversible thermodynamic process: $\Delta H = nCp\ \Delta T$

$\therefore \quad$ Process is isothermal, $\Delta T = 0 \Rightarrow \Delta H = 0$

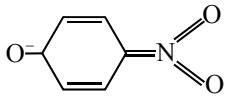
27. **(b)** The nuclear reaction is:

$_{92}U^{238} \longrightarrow {}_2He^4(\alpha) + {}_{90}Th^{234}$

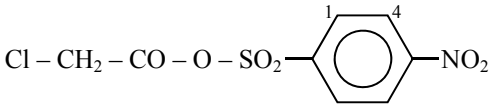
28. **(a)** Isotopes have same atomic numbers (Z) but different mass number (A). Therefore, $_{32}Ge^{76}$ and $_{32}Ge^{77}$ are isotopes.

29. **(d)** Although alcohols are weaker acid than water, it is stronger than ammonia and terminal alkynes.

30. **(b)**



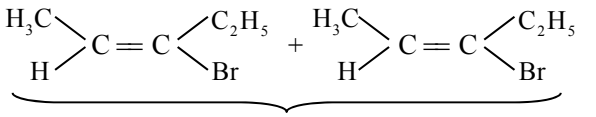
31. **(c)** Anhydrides derived from different monobasic acids are named by citing first parts of the name of the two acids (i.e., the parts preceding the term acid) in alphabetical order.



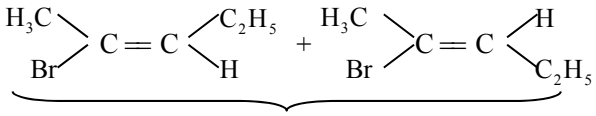
32. **(c)** Primary amides are named by replacing the suffixes "-oic acid", "ic acid" or "carboxylic acid" of the name of the acid corresponding to the acyl group by "amide" or –carboxamide. The substituents prefix corresponding to $-CONH_2$ is 'carbamoyl' which is used, if the compound has another principal group having priority for citation.

33. **(b)** Boiling point of alkane increases with molar mass. Among isomeric alkanes, branching decreases boiling point. Therefore, n-octane has highest boiling point, higher than 2, 2, 3, 3-tetramethyl-butane (an isomer of n-octane).

34. **(b)** $CH_3-C\equiv C-CH_2CH_3+HBr\longrightarrow$



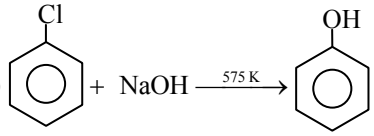
geometrical isomers



geometrical isomers

Therefore, two structural and four configurational isomers.

35. **(c)** $CHCl_2+HNO_3\xrightarrow{\text{Heat}}\underset{\text{Chloropicrin}}{CCl_3\cdot NO_2}+H_2O$

36. **(a)** 

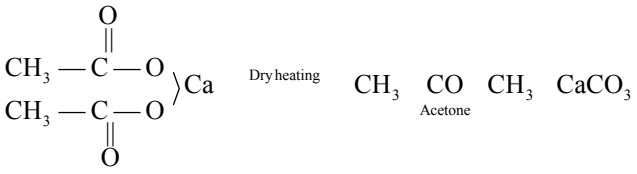
37. **(c)** Coconut oil + Alkali → Soap + Glycerol
It is a saponification reaction.

38. **(a)** $\underset{\text{Starch}}{2(C_6H_{10}O_5)_n}+nH_2O\xrightarrow[\text{(from germinated barley)}]{\text{Diastase}}n\underset{\text{Maltose}}{(C_{12}H_{22}O_{11})}$

$C_{12}H_{22}O_{11}+H_2O\xrightarrow[\text{(from yeast)}]{\text{Maltase}}2\underset{\text{Glucose}}{C_6H_{12}O_6}$

$C_6H_{12}O_6\xrightarrow[\text{(from yeast)}]{\text{Zymase}}2C_2H_5OH+2CO_2$

39. **(d)**



40. **(c)** $CH_3-C\equiv N+C\bar{H}_3Mg^+Br\longrightarrow CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle N-MgBr}{\overset{|}{C}}}=$

$\xrightarrow{\text{Hydrolysis}}CH_3-CO-CH_3+NH_3+Mg\begin{matrix}Br\\OH\end{matrix}$

41. **(b)** Phenol was discovered by Runge in the middle oil fraction of coal-tar distillation and named it 'carbolic acid' (carbo-coil, oleum = oil) or phenol containing 5% water in liquid at room temperature and it is termed as carbolic acid.

42. **(a)** Any electron withdrawing substituent (having-I-effect) stabilises the anion by dispersing the negative charge and therefore, increases the acidity. Chlorine is an electron withdrawing group.

43. **(c)** $C_6H_5NH_2+CHCl_3+\underset{\text{(Alc)}}{3KOH}\longrightarrow$

$C_6H_5NC+3KCl+3H_2O$

44. **(b)** $CH_3NH_2+CHCl_3+3KOH\longrightarrow$

$\underset{\text{Isocyanide}}{R\overset{\oplus}{N}\equiv\overset{\ominus}{C}}+3KCl+3H_2O$

45. **(d)** It is a hemiacetal in equilibrium with its aldehyde form in solution.

46. **(d)** KOH.
The basic strength increases down the group and decreases along a period.

47. **(b)** Na^+
Hydration energy depends on charge of ion and ionic radius. Higher the charge, greater the hydration energy. On the other hand, smaller the size, greater the hydration energy. Charge is considered first for comparison. Hence, Mg^{2+} has higher hydration energy than Na+.

48. **(a)** $Ca(OCl)_2$
Milk of lime reacts with chlorine to form bleaching powder.
$2Ca(OH)_2 + 2Cl_2 \rightarrow CaCl_2 + Ca(OCl)_2 + 2H_2O$

49. **(d)** Both (2) and (3) are correct
Calcium carbonate is strongly heated until it undergoes thermal decomposition to form calcium oxide and carbon dioxide. The calcium oxide (unslaked lime) is dissolved in water to form calcium hydroxide (limewater).
$CaCO_3 \rightarrow CaO + CO_2$

50. **(c)** $Ca_3(PO_4)_2$
$Ca_3(PO_4)_2$. Both Ca and P are needed by human beings. Also they prevent moisture absorbing power of other components such as $MgCl_2$, $CaCl_2$, $CaSO_4$ and $MgSO_4$ present in commercial sodium chloride.

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