PRACTICE SET-4

1. 7.5 gs of a gas occupies 5.8 L of volume at STP. The gas is:

a. NO **b.** N_2O

c. CO **d.** CO_2

2. The mass of a molecule of water is:

a. 3×10^{-26} kg **b.** 3×10^{-25} kg

c. 1.5×10^{-26} kg **d.** 2.5×10^{-26} kg

3. Which of the following exists as covalent crystals in the solid state?

a. Iodine **b.** Silicon

c. Sulphur **d.** Phosphorus

4. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be

a. 7.01% **b.** 4.08%

c. 6.05% **d.** 5.08%

5. Which of the following solutions will have maximum freezing point?

a. 0.01 M urea **b.** 0.01 M KCl

c. 0.01 M $BaCl_2$ **d.** 0.01 M NaCl

6. The osmotic pressure of a solution is given by the relation.

a. $\pi = RT/c$ **b.** $\pi = cT/R$

c. $\pi = Rc/T$ **d.** $\pi/c = RT$

7. A liquid is equilibrium with its vapour at its boiling point. On the average, the molecules in the two phases have equal:

a. inter-molecular forces

b. potential energy

c. kinetic energy

d. total energy

8. Rate of diffusion of a gas is:

a. Directly proportional to its density

b. Directly proportional to its molecular weight

c. Directly proportional to the square root of its molecular weight

d. Inversely proportional to the square root of its molecular weight

9. The proton and neutron are collectively called as:

a. Deutron **b.** Positron

c. Meson **d.** Nucleon

10. Which of the following has the same mass as that of an electron?

a. Photon **b.** Neutron

c. Positron **d.** Proton

11. The normality of 0.3 M phosphorus acid (H_3PO_3) is:

a. 0.1 **b.** 0.9

c. 0.3 **d.** 0.6

12. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are:

a. $0, +1$ and -2 **b.** $+2, +1$ and -2

c. $0, +1$ and $+2$ **d.** $-2, +1$ and -2

13. The standard reduction potentials $E°$, for the half reaction are as:

$Zn = Zn^{2+} + 2e^-$, $E° = +0.76$ V

$Fe = Fe^{2+} + 2e^-$, $E° = 0.41$ V

The emf for the cell reaction,

$Fe^{2+} + Zn \longrightarrow Zn^{2+} + Fe$ is:

a. -0.35 V **b.** $+0.35$ V

c. $+1.17$ V **d.** -1.17 V

14. The standard reduction potentials of Cu^{2+}/Cu and Cu^{2+}/Cu^+ are 0.337 V and 0.153 V respectively. The standard electrode potential of Cu^+/Cu half-cell is:

a. 0.184 V **b.** 0.827 V

c. 0.521 V **d.** 0.490 V

15. The ion that is isolectronic with CO is:

a. CN^- **b.** O_2^+

c. O_2^- **d.** N_2^+

16. Carbon tetrachloride has no net dipole moment because of

a. its planar structure.

b. its regular tetrahedral structure.

c. similar sizes of carbon and chlorine atoms.

d. similar electron affinities of carbon and chlorine.

17. The equilibrium constant for the reaction: $Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons Fe\,SCN^{2+}(aq)$ is 140 at 298 K. The equilibrium constant for the reaction is:

$2Fe^{3+}(aq) + 2SCN^{-}(aq) \rightleftharpoons 2Fe\,SCN^{2+}(aq)$

a. 280 **b.** 140

c. 19600 **d.** 70

18. Consider the gaseous reactions at 300 K,(i) $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$ $: K_1$

(ii) $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$ $: K_2$

The equilibrium constant K_1 and K_2 are related as:

a. $K_2 = \frac{1}{K_1}$ **b.** $K_2 = \frac{K_1}{2}$

c. $K_2 = \frac{1}{K_1^2}$ **d.** $K_2 = K_1^2$

19. According to Bronsted-Lowry concept, the correct order of relative strength of bases follows the order

a. $CH_3COO^- > Cl^- > OH^-$

b. $CH_3COO^- > OH^- > Cl^-$

c. $OH^- > CH_3COO^- > Cl^-$

d. $OH^- > Cl^- > CH_3COO^-$

20. $H_2SO_4^- + OH^- \rightarrow SO_4^{2-} + H_2O$ Which is correct about conjugate acid base pair

a. HSO_4^{2-} is conjugate acid of base SO_4^{2-}

b. HSO_4^- is conjugate base of acid SO_4^{2-}

c. SO_4^- is conjugate acid of base HSO_4^-

d. None of these

21. Consider the chemical reaction $N_2(g)+3H_2(g) \longrightarrow 2NH_3$ (g) The rate of this reaction can be expressed in terms of time derivatives of concentration of $N_2(g)$,$H_2(g)$ or NH_3 (g). Identify the correct relationship amongst the rate expressions.

a. $\text{Rate} = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

b. $\text{Rate} = -\frac{d[N_2]}{dt} = -3\frac{d[H_2]}{dt} = 2\frac{d[NH_3]}{dt}$

c. $\text{Rate} = \frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

d. $\text{Rate} = -\frac{d[N_2]}{dt} = -\frac{d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

22. In a first order reaction the concentration of reactant decreases from 800 mol $/dm^3$ to 50 mol/dm^3 in 2×10^4 s. The rate constant of reaction in s^{-1} is:

a. 2×10^4 **b.** 3.45×10^{-5}

c. 1.386×10^{-4} **d.** 2×10^{-4}

23. The capacity to bring about coagulation increases with:

a. Ionic radii **b.** Atomic radii

c. Valency of an ion **d.** Size of an ion

24. Gold number gives:

a. The amount of gold present in the colloid.

b. The amount of gold required to break the colloid.

c. The amount of gold required to protect the colloid.

d. None of these

25. Which of the following reactions defines ΔH_f^o ?

a. $C_{(diamond)} + O_2(g) \longrightarrow CO_2(g)$

b. $\frac{1}{2}H_2(g) + \frac{1}{2}F_2(g) \longrightarrow HF(g)$

c. $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

d. $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g)$

26. Spontaneous adsorption of a gas on solid surface is an exothermic process because

a. ΔH increases for system

b. ΔS increases for gas

c. ΔS decreases for gas

d. ΔG increases for gas

27. In a radioactive change: **A.** ${}^{A}_{Z}P \longrightarrow {}^{A}_{Z+1}Q \longrightarrow {}^{A-4}_{Z-1}R \longrightarrow {}^{A-4}_{Z-1}S$ radiation are emitted in the sequence.

a. α,β,γ **b.** β,α,γ

c. γ,α,β **d.** β,γ,α

28. During the fission of U-235, a large amount of energy of the order of 180 MeV is generated per nucleus fissioned. The amount of energy released by the fission of 0.235 g of U-235 is:

a. 1.08×10^{23} kJ **b.** 1.08×10^{7} kJ

c. 1.73×10^{16} kJ **d.** 1.73×10^{7} kJ

29. What is the decreasing order of strength of the bases? $OH^-, NH_2^-, H-C\equiv C^-$ and $CH_3-CH_2^-$

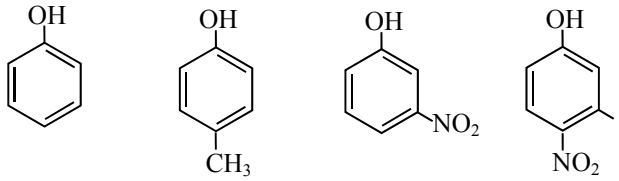
a. $CH_3-CH_2^- > NH_2^- > H-C\equiv C^- > OH^-$

b. $H-C\equiv C^- > CH_3-CH_2^- > NH_2^- > OH^-$

c. $OH^- > NH_2^- > H-C\equiv C^- > CH_3-CH_2^-$

d. $NH_2^- > H-C\equiv C^- > OH^- > CH_3-CH_2^-$

30. In the following compounds:



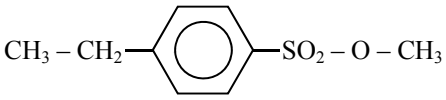
(I) (II) (III) (IV)

The order of acidity is:

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

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

31. Assign the IUPAC name of the following compound.



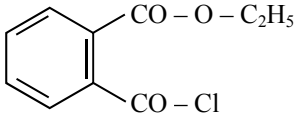
a. Ethyl 4-ethyl benzenesulphonate

b. Methyl 4-ethylbenzenesulphonate

c. Methyl 4-ethyl cyclohexanesulphonate

d. None of the above

32. Write the IUPAC name of the following compound.



a. 2-(ethoxycarbonyl) benzoyl chloride

b. Ethyl 2-(chlorocarbonyl) hexanoate

c. Ethyl 2-(chlorocarbonyl) benzoate

d. None of the above

33. Baeyer's reagents is?

a. alkaline permanganate solution.

b. acidified permanganate solution.

c. neutral permanganate solution.

d. aqueous bromine solution.

34. Acidic hydrogen is present in?

a. ethyne **b.** ethene

c. benzene **d.** ethane

35. 1-chlorobutane on reaction with alcoholic KOH gives:

a. 1-butene **b.** 1-butanol

c. 2-butene **d.** 2-butanol

36. The reaction of chlorine with propene at $400-600°C$ gives mainly.

a. $CH_3CHClCH_2Cl$ **b.** $CH_2(Cl)-CH(Cl)-CH_2(Cl)$

c. $CH_3CH=CHCl$ **d.** $ClCH_2CH=CH_2$

37. Which one of the following will produce a primary alcohol by reacting with CH_3MgI

a. Acetone **b.** Methyl cyanide

c. Ethylene oxide **d.** Ethyl acetate

38. The fermentation of starch to give alcohol occurs mainly with the help of:

a. O_2 **b.** Air

c. CO_2 **d.** Enzymes

39. From which of the following tertiary butyl alcohol is obtained by the action of methyl magnesium iodide?

a. HCHO **b.** CH_3CHO

c. CH_3COCH_3 **d.** CO_2

40. $CH_3-CH_2-C\equiv CH \xrightarrow[H_2O]{R}$ Butanone, R is:

a. Hg^{++} **b.** $KMnO_4$

c. $KClO_3$ **d.** $K_2Cr_2O_7$

41. Fats and oils are:

a. Acids **b.** Alcohols

c. Esters **d.** Hydrocarbons

42. Vinegar obtained from sugarcane has:

a. CH_3COOH **b.** HCOOH

c. C_6H_5COOH **d.** CH_3CH_2COOH

43. Which of the following compound gives dye test?

a. Aniline

b. Methylamine

c. Diphenylamine

d. Ethylamine

44. In hydrolysis of aniline, the reagent used is:

a. Dil. HCl

b. Acetyl chloride

c. CH_3OH

d. None of these

45. Which of the following is a protein?

a. Pepsin **b.** Adrenaline

c. ATP **d.** Glutamine

46. Carnallite is the mineral of:

a. Na **b.** Ca

c. Mg **d.** None of the Above

47. The wire of flash bulb is made up of:

a. Mg **b.** Ag

c. Cu **d.** Ba

48. The basic strength of which hydroxide is maximum

a. LiOH **b.** NaOH

c. $Ca(OH)_2$ **d.** KOH.

49. The composition of Sorels cement is

a. $KCl \times MgCl_2 \times 6H_2O$

b. $MgCl_2 \times 5MgO \times (xH_2O)$

c. $MgCO_3 \times CaCO_3$

d. $CaSO_4 \times 2H_2O$

50. Which of the following alkali metals has the least melting point?

a. Na **b.** K

c. Rb **d.** Cs.

Answers and Solutions

1. **(a)** $\because$ 5.8 L of gas has mass $= 7.5$gm

$\therefore$ 22.4 L of gas has mass $= \frac{7.5}{5.8} \times 22.4 = 28.96$

So molecular weight = 29

So, molecular formula of compound is NO.

2. **(a)** 6×10^{23} molecules has mass $= 18 gm$

1 molecule has mass

$= \frac{18}{6 \times 10^{23}} = 3 \times 10^{-23}$ gm $= 3 \times 10^{-26}$ kg.

3. **(b)** Silicon exists as covalent crystal in solid state. (Network like structure, as seen in diamond).

4. **(b)** From the valency of M^{2+} and M^{3+}, it is clear three M^{2+} ions will be replaced by M^{3+} causing a loss of one M^{3+} ion

Metal oxide $M_{0.98}O$, if x ions of M are in +3 state then

$3x + (0.98 - x)\,2 = 2$

$x = 0.04$

Therefore % of $M^{3+} = \frac{0.04 \times 100}{0.98} = 4.08\%$

5. **(a)** 0.01 M urea will have maximum freezing point because it will have lowest depression in freezing point (being non-electrolyte).

6. **(d)** $\pi = CRT$

$\therefore \quad \pi / C = RT$

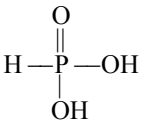
7. **(c)** At liquid-vapour equilibrium at boiling point. Molecules in two phases posses the same kinetic energy.

8. **(d)** Rate of effusion $\alpha \frac{1}{\sqrt{m}}$: definition.

9. **(d)** Nucleus consists of proton and neutron both are called as nucleon.

10. **(c)** Positron $(+1e^0)$ has the same mass as that of an electron $(-1e^0)$.

11. **(d)** Phosphorus acid is a dibasic acid as:



Only two replaceable hydrogens

Therefore, Normality

= molarity basicity $\times$ basicity

= 0.3 x 2 = 0.6

12. **(a)** In S_8, oxidation number of S is 0, elemental state.

In S_2F_2, F is n -1 oxidation state, hence S is in $+1$ oxidation state.

In H_2S, H is in $+1$ oxidation state, hence S is in -2 oxidation state.

13. **(b)** $Fe^{2+} + 2e^- \longrightarrow Fe; \qquad E° = -0.41$ V

$Zn \longrightarrow Zn^{2+} + 2e^-; \qquad E° = +0.76$ V

$\Rightarrow \quad Fe^{2+} + Zn \longrightarrow Zn^{2+} + Fe; \qquad E° = +0.35$ V

14. **(c)** E° is an intensive property:

E° $\quad \Delta G° = -nE°F$

(i) $Cu^{2+} + 2e^- \longrightarrow Cu \quad 0.337$ V $\qquad -0.674$ F

(ii) $Cu^{2+} + e^- \longrightarrow Cu^+ \quad 0.153$ V $\qquad -0.153$ F

Subtracting (ii) from (i) gives:

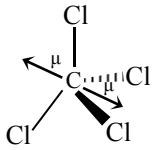
$Cu^+ + e^- \longrightarrow Cu \; \Delta G° = -0.521F = -nE°F$

$\Rightarrow \quad E° = 0.521$ V $\qquad \because n = 1$

15. **(a)** CO has a total of 14 electrons and CN^- also has 14 electrons:

$$C(6e^-) + N(7e^-) + e^- \longrightarrow CN^-(14e^-)$$

16. **(b)** CCl_4 has a regular tetrahedral shape.



Net dipole = 0

17. **(c)** $K = \dfrac{[FeSCN^{2+}]}{[Fe^{3+}][SCN^-]} = 140$;

$$K' = \frac{[FeSCN^{2+}]^2}{[Fe^{3+}]^2[SCN^-]^2} = (140)^2 = 19600$$

18. **(c)** $K_1 = \dfrac{[NO_2]}{[NO][O_2]^{1/2}}$ and $K_2 = \dfrac{[NO]^2[O_2]}{[NO_2]} = \dfrac{1}{K_1^2}$

$\therefore \quad K_2 = \dfrac{1}{K_1^2}$

19. **(c)** Relative strength of bases can be shown by their conjugated acids. Conjugate acid of OH^- is H_2O which is a weak acid conjugate acid of CH_3COO^- is CH_3COOH which is stronger than H_2O. while conjugate acid of Cl^- is HCl which is strongest out of there. so the order of relative strength of bases is $OH^- > CH_3COO^- > Cl^-$.

20. **(a)** $\underset{\text{Conjugate acid}}{HSO_4^-} + OH^- \rightarrow \underset{\text{Conjugate base}}{SO_4^{2-}} + H_2O$

21. **(a)** For any general reaction, $aA + bB \longrightarrow cC + dD$

$$\text{Rate} = -\frac{1}{a}\frac{d[A]}{dt} = -\frac{1}{b}\frac{d[B]}{dt} = \frac{1}{C}\frac{d[C]}{dt} = \frac{1}{d}\frac{d[D]}{dt}$$

$\Rightarrow$ For $N_2 + 3H_2 \longrightarrow 2NH_3$

$$\text{Rate} = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$$

22. **(c)** For a first order reaction, $kt = \ln\dfrac{[A]_0}{[A]}$

$$\Rightarrow \quad k = \frac{1}{t}\ln\frac{[A]_0}{[A]} = \frac{1}{2\times10^4}\ln\frac{800}{50} = \frac{4\ln 2}{2\times10^4}s^{-1} = 1.386\times10^{-4}s^{-1}$$

23. **(c)** The amount of electrolyte required to coagulate a fixed amount of a sol depends upon the valency of flocculating ion.

24. **(d)** Gold no. is a measure of protective power of a lyophilic colloid.

25. **(b)** $\frac{1}{2}H_2(g) + \frac{1}{2}F_2(g) \longrightarrow HF(g)$

Here $\Delta H°$ = Standard molar enthalpy of formation of HF (g).

26. **(c)** For spontaneous process $\Delta G < 0$ Also; $\Delta G = \Delta H - T\Delta S$ for adsorption of gas on solid surface $\Delta S < 0$. Therefore, in order to be $\Delta G < 0, \Delta H$ must be negative.

27. **(b)** The complete sequence is:

$${}^{A}_{Z}P \xrightarrow{-\beta} {}^{A}_{Z+1}Q \xrightarrow{-\alpha} {}^{A-4}_{Z-1}R \xrightarrow{\gamma} {}^{A-4}_{Z-1}S$$

28. **(d)** Number of nuclei in 0.235 g U-235

$$= \frac{6.02\times10^{23}\times0.235}{235} = 6.02\times10^{20}$$

Amount of energy released $= 6.02\times10^{20}\times180$ MeV

$= 6.02\times10^{20}\times180\times1.6\times10^{-16}$ kJ $= 1.73\times10^7$ kJ

29. **(a)** $CH_3CH_2^- > NH_2^- > H—C\equiv C^- > HO^-$

It is because, the order of acid-strength of their conjugate acid is:

$CH_3CH_2 < NH_3 < H—C\equiv C—H < H_2O$:

Acid strength.

30. **(d)** Nitro group from para position exert electron withdrawing resonance effect, increases acidity of phenol the most. This is followed by meta nitrophenol in which nitro group exert electron withdrawing effect on acidity. $CH_3—$ is an electron donating group, deceases acid strength. Hence, the overall order is:

IV > III > I > II

31. **(b)** The parent acid is 4-ethylbenzene sulphonic acid. The alkyl group which replaces the acidic H-atom is methyl group.

32. **(c)** –COO– group has priority for citation as principal functional group. The acyl halide is expressed by a prefix 'chlorocarbonyl'.

33. **(a)** Baeyer's reagent is cold, dilute, alkaline permanganate solution, used to detect presence of olefinic bonds.

34. **(a)** Terminal alkynes are slightly acidic, forms salt with very strong base like Na, $NaNH_2$ etc.

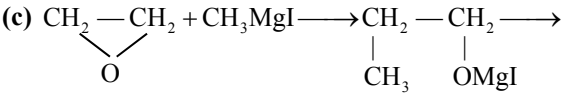
$$\underset{\text{ethyne}}{H-C\equiv C-H} + Na \xrightarrow{\Delta} H-C\equiv C^{-}Na^{+} + \frac{1}{2}H_2\uparrow$$

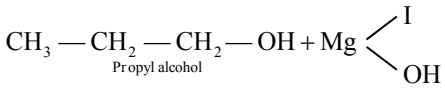
35. **(a)** $CH_3CH_2CH_2CH_2Cl \xrightarrow{\text{alc. KOH}} CH_3CH_2CH=CH_2$

36. **(d)** $CH_2=CH-CH_3 \xrightarrow[400-600^{\circ}C]{Cl_2} CH_2=CH-CH_2Cl$

It is known as allylic substitution reaction.

37. **(c)**





38. **(d)** $\text{Starch} \xrightarrow{\text{Enzymes}} \text{Alcohol}$

39. **(c)** $\underset{\text{Acetone}}{CH_3COCH_3} \xrightarrow{CH_3MgI} \underset{\text{tert-Butylalcohol}}{(CH_3)_3COH}$

40. **(a)** It is hydration of alkynes.

$$CH_3-CH_2-C\equiv CH \xrightarrow[H_2O]{Hg^{++}} \underset{\text{Butanone}}{CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3}$$

41. **(c)** Fats and oil jointly known as lipids which are the ester of glycerol with high fatty acid.

42. **(a)** Acetic acid is the chief constituent of vinegar and hence its name (Latin: acetum = vinegar).

43. **(a)** Basically all the Azo dye are derivatives of aniline.

44. **(a)** All amines react with mineral acids such as HCl, H_2SO_4, HNO_3 etc. to form salts which are soluble in water.

45. **(a)** Pepsin is a protein.

46. **(c)** Mg

Carnallite is an evaporite mineral a hydrated potassium magnesium chloride. It is variably coloured yellow to white, reddish or blue. It occurs with a sequence of potassium and magnesium evaporite. It is an uncommon double chloride mineral that forms under specific conditions. It is an important source of potash.

47. **(a)** Mg

Magnesium metal is used for the preparation of the wire of flash bulb.

48. **(d)** KOH.

The basic strength increases down the group and decreases along a period.

49. **(b)** $MgCl_2 \times 5MgO \times (xH_2O)$

Mixture of $MgCl_2$ and MgO is called Sorels cement. It is $MgCl_2 \times 5MgO \times (xH_2O)$

50. **(d)** Cs.

Atomic size increases as we move down the alkali group. As a result, the binding energies of their atoms in the crystal lattice decrease. Also, the strength of metallic bonds decreases on moving down a group in the periodic table. This causes a decrease in the melting point. Among the given metals, Cs is the largest and has the least melting point.

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