PRACTICE SET-2

1. The unit J Pa^{-1} is equivalent to:

a. m^3 **b.** cm^3

c. dm^3 **d.** None of these

2. *n g* of substance *X* reacts with *m g* of substance *Y* to form *p g* of substance *R* and *q g* of substance *S*. This reaction can be represented as, $X + Y = R + S$. The relation which can be established in the amounts of the reactants and the products will be:

a. $n - m = p - q$ **b.** $n + m = p + q$

c. $n = m$ **d.** $p = q$

3. A substance A_xB_y crystallises in a face centred cubic (fcc) lattice in which atoms 'A' occupy each corner of the cube and atoms 'B' occupy the centres of each face of the cube. Identify the correct composition of the substance A_xB_y

a. AB_3

b. A_4B_3

c. A_3B

d. Composition cannot be specified

4. Which of the following fcc structure contains cations in alternate tetrahedral voids?

a. NaCl **b.** ZnS

c. Na_2O **d.** CaF_2

5. Molar freezing point depression constant can be expressed in terms of freezing point of solvent (T_f^o), heat of fusion (ΔH_f), molar mass (M) as;

a. $K_f = \dfrac{RT_f^o\ M}{\Delta H_f \times 1000}$ **b.** $K_f = \dfrac{RT_f^{o2}}{\Delta H_f \times 1000}$

c. $K_f = \dfrac{\Delta H_f \times 1000 \times M}{RT_f^{o2}}$ **d.** $K_f = \dfrac{RT_f^{o2}\ M}{1000 \times \Delta H_f}$

6. The ratio of the value of any colligative property of KCl solution to that for sugar solution is nearly.

a. 0.1 **b.** 0.5

c. 2.0 **d.** 2.5

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

a. $\dfrac{1}{3}$ **b.** $\dfrac{1}{2}$

c. $\dfrac{1}{3}$ **d.** $\dfrac{1}{3} \times \dfrac{273}{298}$

8. Helium atom is two times heavier than a hydrogen molecule. At 298 K, the average kinetic energy of a helium atom is:

a. two times that of a hydrogen molecule.

b. same as that of a hydrogen molecule.

c. four times that of a hydrogen molecule.

d. half that of a hydrogen molecule.

9. The mass of 1 mole of electrons is:

a. 9.1×10^{-28} g **b.** 1.008 mg

c. 0.55 mg **d.** 9.1×10^{-27} g

10. The ratio of specific charge of a proton and an α-particle is:

a. 2 : 1 **b.** 1 : 2

c. 1 : 4 **d.** 1 : 1

11. The volume strength of 1.5 N H_2O_2 is:

a. 4.8 **b.** 8.4

c. 3.0 **d.** 8.0

12. For the redox reaction:

$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$

The correct coefficients of the reactants for the balanced reaction are:

MnO_4^-	$C_2O_4^{2-}$	H^+
a. 2	5	16
b. 16	5	2
c. 5	16	2
d. 2	16	5

13. A solution containing one mole per litre of each $Cu(NO_3)_2$, $AgNO_3$, $Hg_2(NO_3)_2$ and $Mg(NO_3)_2$ is being electrolysed by using inert electrodes. The values of standard electrode potentials in volts (reduction potential) are:

$Ag^+ / Ag = +0.80, Hg_2^{2+} / 2Hg = +0.79$

$Cu^{2+} / Cu = +0.34, Mg^{2+} / Mg = -2.37$

With increasing voltage, the sequence of deposition of metals on the cathode will be:

a. Ag, Hg, Cu, Mg **b.** Mg, Cu, Hg, Ag

c. Ag, Hg, Cu **d.** Cu, Hg, Ag

14. The electric charge for electrode deposition of 1 g equivalent of a substance is:

a. 1 ampere per second

b. 96,500 coulombs per second

c. 1 ampere for 1 hour

d. charge on 1 mole of electrons

15. Which of the following compound is covalent?

a. H_2 **b.** CaO

c. KCI **d.** Na_2S

16. Element X is strongly electropositive and element Y is strongly electronegative, both are univalent. The compound formed would be:

a. X^+Y^- **b.** X^-Y^+

c. $X-Y$ **d.** $X \rightarrow Y$

17. If concentration are expresses as mol L^{-1}, the equilibrium constant, K for the reaction $2N_2O_5(g) \rightleftharpoons 4NO_2(g) + O_2(g)$ has the units.

a. $mol^3\ L^{-3}$ **b.** $mol\ L^{-1}$

c. $mol^3\ L^{-1}$ **d.** no units

18. For the reaction $2A(g) + B_2(g) \rightleftharpoons 2AB_2(g)$ the equilibrium constant K_p at 300 K is 16.0. The value of K_p for $AB_2(g) \rightleftharpoons A(g) + \frac{1}{2}B_2(g)$ is:

a. 8 **b.** 0.25

c. 0.125 **d.** 32

19. The degree of hydrolysis in hydrolytic equilibrium $A^- + H_2O \rightleftharpoons HA + OH^-$ at salt concentration of 0.001 M is: $\left(K_a = 1\times10^{-5}\right)$

a. 1×10^{-3} **b.** 1×10^{-4}

c. 5×10^{-4} **d.** 1×10^{-6}

20. If pK_b for fluoride ion at 25^oC is 10.83, the ionisation constant of hydrofluoric acid in water at this temperature is:

a. 1.74×10^{-3} **b.** 3.52×10^{-3}

c. 6.75×10^{-4} **d.** 5.38×10^{-2}

21. A catalyst is a substance which

a. increases the equilibrium concentration of the product

b. changes the equilibrium constant of the reaction

c. shortens the time to reach equilibrium

d. supplies energy to the reaction

22. The half-life period of a radioactive element is 140 days. After 650 days, 1 g of the element will reduce to:

a. $\frac{1}{2}$g **b.** $\frac{1}{4}$g

c. $\frac{1}{8}$g **d.** $\frac{1}{16}$g

23. A catalyst is used in a reaction to

a. change the nature of reaction products.

b. increase the reaction yield.

c. decrease the need for reactants.

d. decrease the time required for the reaction.

24. Which one of the following is not represented by sols?

a. Absorption **b.** Tyndall effect

c. Flocculation **d.** Paramagnetism

25. The ΔH_f^o for $CO_2(g), CO(g)$ and $H_2O(g)$ are –393.5, –110.5 and –241.8 kJ mol^{-1} respectively. The standard enthalpy change (in kJ mol^{-1}) for the reaction $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(g)$ is:

a. 524.1 **b.** + 41.2

c. – 262.5 **d.** – 41.2

26. In thermodynamics, a process is called reversible when

a. surrounding and system change into each other.

b. there is no boundary between system and surroundings.

c. the surroundings are always in equilibrium with the system.

d. the system changes into the surroundings spontaneously.

27. In the reaction, $Po \xrightarrow{\alpha} Pb \xrightarrow{\beta} Bi$. If Bi belongs to group 15, to which group Po belongs?

a. 14 **b.** 45

c. 13 **d.** 16

28. The number of α-particles emitted by $^{218}_{84}Ra$ in changing to stable isotope $^{206}_{82}Pb$ is:

a. 3 **b.** 4

c. 6 **d.** 2

29. The compound which gives the most stable carbonium ion on dehydrations is:

a. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2OH$ **b.** $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OH$

c. $CH_3-CH_2-CH_2-CH_2OH$

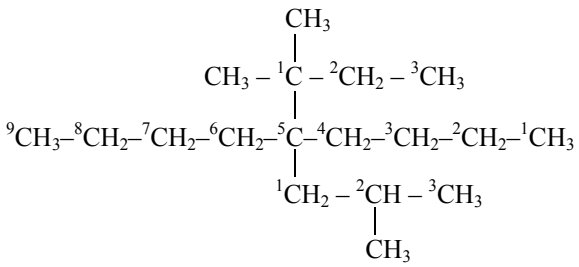
d. $CH_3-\overset{\displaystyle OH}{\overset{|}{CH}}-CH_2-CH_3$

30. The number of sigma and pi-bonds in 1-butene 3-yne are

a. 5 sigma and 5 pi **b.** 7 sigma and 3 pi

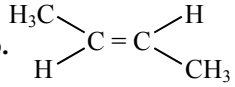
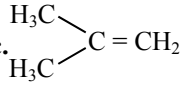
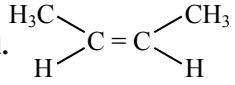
c. 8 sigma and 2 pi **d.** 6 sigma and 4 pi

31. Assign the IUPAC name.



a. 5-(2-methylpropyl)-5-(1,1-dimethylpropyl) nonane
b. 5-(1-1-dimethylpropyl)-5-(2-methylpropyl) nonane
c. 5,5-dibutyl-2,5,5-trimethylheptane
d. 5,5-dibutyl-3,3,6-trimethylheptane

32. Match List I and List II and select the correct answer using the codes given below.

	List I (Structures)	List II (IUPAC names)
a.	$CH_3 - CH_2 - CH = CH_2$	(P) 2-methylprop-1-ene
b.		(Q) but-1-ene
c.		(R) *cis*-but-2-ene
d.		(S) *trans*-but-2-ene

Codes :	A	B	C	D
a.	Q	R	P	S
b.	R	Q	S	P
c.	Q	S	P	R
d.	R	S	Q	P

33. The compound with highest boiling point is?
a. 2-methyl butane **b.** n-pentane
c. 2, 2-dimethyl propane **d.** n-hexane

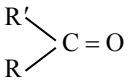
34. The compound 1, 2-butadiene has?
a. only sp hybridised carbon atoms.
b. only sp^2 hybridised carbon atoms.
c. both sp and sp^2 hybridised carbon atoms.
d. sp, sp^2 and sp^3 hybridised carbon atoms.

35. The product of reaction of alcoholic silver nitrite with ethyl bromide is:
a. Ethene **b.** Ethyl alcohol
c. Nitroethane **d.** Ethyl nitrite

36. When chloroform is exposed to light and damp air, it gives (among other products):
a. Carbon tetrachloride **b.** Carbonyl chloride
c. Mustard gas **d.** Carbon monoxide

37. Which of the following is dihydric alcohol?
a. Glycerol **b.** Ethylene glycol
c. Catechol **d.** Resorcinol

38 Which of the following are isomers?
a. Methyl alcohol and dimethyl ether
b. Ethyl alcohol and dimethyl ether
c. Acetone and acetaldehyde
d. Propionic acid and propanone

39. In the group  the carbonyl carbon is joined to other atoms by:
a. two sigma and one pi bonds
b. three sigma and one pi bonds
c. one sigma and two pi bonds
d. two sigma and two pi bonds

40. IUPAC name of CCl_3CHO is:
a. Chloral
b. Trichloro acetaldehyde
c. 1, 1, 1-trichloroethanal
d. 2, 2, 2-trichloroethanal

41. The general formula $(RCO)_2O$ represents:
a. An ester
b. A ketone
c. An ether
d. An acid anhydride

42. A tribasic acid is:
a. Oxalic acid
b. Tartaric acid
c. Lactic acid
d. Citric acid

43. Which of the following would be most reactive towards nitration?
a. Benzene
b. Nitrobenzene
c. Toluene
d. Chlorobenzene

44. Aniline reacts with acetaldehyde to form:
a. Schiff's base **b.** Carbylamine
c. Imine **d.** None of these

45. Orlon has a unit:
a. Vinyl cyanide **b.** Acrolein
c. Glycol **d.** Isoprene

46. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.2×10^{-4} mol L^{-1}. Solubility product of $Ag_2C_2O_{42}$ is

a. 2.66×10^{-12} **b.** 4.5×10^{-11}

c. 5.3×10^{-12} **d.** 2.42×10^{-8}

47. In a reversible chemical reaction at equilibrium, if the concentration of any one of the reactants is doubled, then the equilibrium constant will

a. Also be doubled **b.** Be halved

c. Remain the same **d.** Become one-fourth

48. A dibromo derivative of an alkane reacts with sodium metal to form an alicyclic hydrocarbon. The derivative is _____.

a. 2, 2-dibromobutane **b.** 1, 1-dibromopropane

c. 1, 4-dibromobutane **d.** 1, 2-dibromoethane

49. The position of double bond in alkenes can be located by:

a. Hydrogenation of oil **b.** Ozonolysis

c. Photolysis **d.** Hydration

50. CsOH is

a. Strongly basic **b.** Weakly basic

c. Slightly acidic **d.** Amphoteric.

Answers and Solutions

1. **(a)** JPa^{-1}; Unit of work is Joule and unit of pressure is Pascal.

Dimension of Joule, i.e., work

$= F \times L = MLT^{-2} \times L$

$= \left[ML^2T^{-2}\right]$

$$\frac{1}{Pa} = \frac{1}{\text{Pressure}} = \frac{1}{\frac{F}{A}} = \frac{1 \times A}{F} = \frac{L^2}{MLT^{-2}}$$

So, $JPa^{-1} = \left[ML^2T^2\right]\frac{L^2}{MLT^{-2}} = \left[L^3\right]$.

2. **(b)** $\underset{ng}{X} + \underset{mg}{Y} \rightleftharpoons \underset{pg}{R} + \underset{qg}{S}$

$n + m = p + q$ by law of conservation of mass.

3. **(a)** In cubic system, a corner contribute $\frac{1}{8}$th part of atom to one unit cell and a face centre contribute $\frac{1}{2}$ part of atom to one unit cell. Therefore,

Number of A per unit cell $= \frac{1}{8} \times 8 = 1$

Number of B per unit cell $= \frac{1}{2} \times 6 = 3$

$\Rightarrow$ Formula $= AB_3$

4. **(b)** In ZnS, S^{2-} (sulphide ions) are present at fcc position giving four sulphide ions per unit cell. To comply with $1:1$ stoichiometry, four Zn^{2+} ions must be present in four alternate tetrahedral voids out of eight tetrahedral voids present.

In $NaCl, Na^+$ ions are present in octahedral voids while in Na_2O, Na^+ ions are present in all its tetrahedral voids giving the desired $2:1$ stoichiometry. In CaF_2, Ca^{2+} ions occupies fcc positions and all the tetrahedral voids are occupied by fluoride ions.

5. **(a)** Osmotic pressure depends upon the number of particles given by solute. Glucose remains undissociated, sodium chloride gives $(Na^+ + Cl^-)$ 2 mole particles per mole and barium chloride gives $(Ba^{2+} + 2Cl^-)$ 3 mole particles per mole. Therefore, correct order is A.

6. **(c)** Colligative property $\propto$ Number of particles

$$\frac{\text{Colligative property (KCl)}}{\text{Colligative property (sugar)}} = \frac{2}{1} = 2$$

7. **(a)** If x g of both oxygen and methane are mixed then :

Mole of oxygen $= \frac{x}{32}$

Mole of methane $= \frac{x}{16}$

$\Rightarrow$ Mole fraction of oxygen $= \frac{\frac{x}{32}}{\frac{x}{32} + \frac{x}{16}} = \frac{1}{3}$

According to law of partial pressure:

Partial pressure of oxygen (P_{O_2}) = mole-fraction $\times$ total pressure

$\Rightarrow$ $\frac{P_{O_2}}{p} = \frac{1}{3}$

8. **(b)** According to kinetic theory, average kinetic energy $(\in) = \frac{3}{2}k_BT$ Where, k_B is Boltzmann's constant. Since, it is independent of molar mass, it will be same for He and H_2 at a given temperature.

9. **(c)** 1 mole of electron

$= 6.023 \times 10^{23}$ electron

Mass of one electron

$= 9.1 \times 10^{-28}$ gm

Mass of 1 mole of electron

$= 6.023\times10^{23}\times9.1\times10^{-28}\,\text{gm} = 5.48\times10^{-4}\,\text{gm}$

$= 5.48\times10^{-4}\times1000\,\text{mg} = 0.548\,\text{gm} \approx 0.55\,\text{g}.$

10. **(a)** Charge on proton = +1 unit, charge on α particle = + 2 units, 2 : 1.

11. **(b)** Volume strength of H_2O_2 = Normality $\times 5.6$
$= 1.5\times5.6 = 8.4\,\text{V}$

12. **(a)** The balanced redox reaction is:
$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 16H_2O$
Hence, the coefficients of reactants in balanced reaction are 2, 5 and 16 respectively.

13. **(c)** In aqueous solution, only those ions that are less electropositive than hydrogen $(E° > 0)$ would be deposited. Therefore, in the present case, only Ag, Hg and Cu would be deposited on passing electricity through aqueous solution of these ions, Mg will not be deposited.
Also, higher the value of $E°$, easier will be their reduction, therefore, the sequence in which ions will be deposited on increasing voltage across the electrodes is: Ag, Hg, Cu.

14. **(d)** One gram equivalent of an electrolyte required 1.0 mole of electronic charge for discharging.

15. **(a)** H_2 is a covalent, diatomic, molecule with a sigma covalent bond between two hydrogen atoms.

16. **(a)** Strongly electropositive, univalent, X will form an 1 : 1 ionic compound with strongly electronegative, univalent $Y-$ $X + Y \longrightarrow X^+Y^-$.

17. **(a)** $K = \dfrac{[NO_2]^4[O_2]}{[N_2O_5]^2}\dfrac{(\text{mol/L})^4(\text{mol/L})}{(\text{mol/L})^2} = \text{mol}^3\text{L}^{-3}$

18. **(b)** $K = \dfrac{[AB_2]^2[O_2]}{[A]^2[B_2]} = 16.0 \quad \Rightarrow \quad K = \dfrac{[A][B_2]^{1/2}}{[AB_2]}$

Squaring $K^{1/2} = \dfrac{[A]^2[B_2]}{[AB_2]^2} \quad \therefore \quad \dfrac{1}{K'^2} = \dfrac{[AB_2]^2}{[A]^2[B_2]} = 16$

$\therefore \quad K'^2 = \dfrac{1}{16} \quad \text{or} \quad K' = \dfrac{1}{4} = 0.25\ 0000$

19. **(a)** $K_h = \dfrac{K_w}{K_a} = \dfrac{10^{-14}}{1\times10^{-5}} = 10^{-9}$

$K_h = \alpha^2 C;\ \alpha = \sqrt{\dfrac{K_h}{C}} = \sqrt{\dfrac{1\times10^{-9}}{.001}} = 1\times10^{-3}$

20. **(c)** $K_a \times K_b = K_w$

$\therefore \quad K_a = \dfrac{K_w}{K_b} = \dfrac{10^{-14}}{1.48\times10^{-11}} = 6.75\times10^{-4}$

21. **(c)** A catalyst increases the rate of reaction but by the same factor to both forward and backward directions. Hence, a catalyst shorten the time required to reach the equilibrium.

22. **(d)** 560 days = $\dfrac{560}{140}$ = 4 half lives. Amount of reactant remaining after n half lives

$= \left(\dfrac{1}{2}\right)^n \times \text{Initial amount} = \left(\dfrac{1}{2}\right)^4 \times 1.0\text{g} = \dfrac{1}{16}\text{g}$

23. **(d)** A catalyst is used to decrease the time required for the reaction hence it can decease or increase the rate of reaction.

24. **(d)** Absorption, Tyndall effect and flocculation all are related to sol but paramagnetism is not represented by sol.

25. **(b)** $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(g)$

$\Delta H = \Sigma_f H^o(\text{products}) - \Sigma\Delta_f H^o(\text{reac tan ts})$

$= -110.5 - 241.8 - (-393.5) = +41.20\ \text{kJ}$

26. **(c)** In a reversible thermodynamic process, system always remains in equilibrium with surrounding.

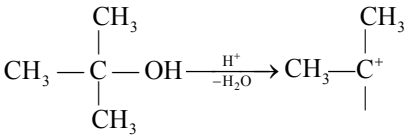
27. **(d)** $\underset{\text{Group 16}}{\text{Po}} \xrightarrow{\alpha} \underset{\text{Group 14}}{\text{Pb}} \xrightarrow{\beta} \underset{\text{Group 15}}{\text{Bi}}$

28. **(a)** $^{218}_{84}Ra \longrightarrow {}^{206}_{82}Ra + x\ {}^4_2He + {}^0_{-1}e$

Comparing mass numbers $218 = 206 + 4x + 0$

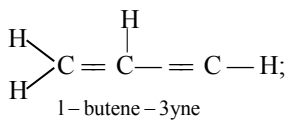
$\Rightarrow \quad 4x = 12 \quad \text{or} \quad x = 3$

29. **(b)**



(3°, most stable alkyl carbocation)

30. **(b)**

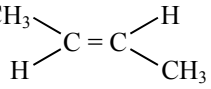


1 – butene – 3yne

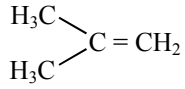
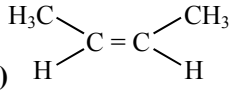
It has 7 sigma and 3 pi-bonds.

31. **(b)** If there is a side chain within the side-chain (i.e., if the side-chain is substituted), the name of substituted side-chain begins with the first letter of its complete name. Thus, 1, 1-dimethylpropyl is alphabetised before 2-

methylpropyl. Hence, the name corresponding to **(b)** is the correct name.

32. **(a)** **(a)** $CH_3-CH_2-CH=CH_2$ **(b)** 

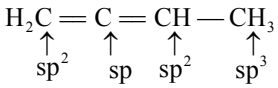
(but-1-ene) (cis-but-2-ene)

(c)  **(d)** 

(2-methyl prop-1-ene) (*trans*-but-2-ene)

33. **(d)** Among alkanes, boiling point increases with molar mass. Among isomeric alkanes, branching decreases boiling point. Therefore, n-hexane has highest boiling point among these.

34. **(d)** Structural formula of 1, 2-butadiene is:

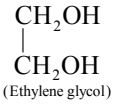


35. **(c)** $CH_3CH_2Br + AgNO_2 \xrightarrow{\text{alcoholic}}$

$\underset{\text{Nitroethane}}{CH_3CH_2NO_2} + AgBr$

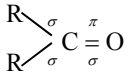
36. **(b)** $CHCl_3 + \frac{1}{2}O_2 \longrightarrow \underset{\text{Carbonyl chloride}}{COCl_2} + HCl$

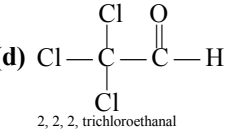
37. **(b)** Glycols are dihydric alcohols (having two hydroxyl groups). Ethylene glycol is the first member of this series.



(Ethylene glycol)

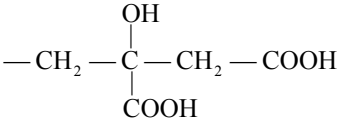
38. **(b)** C_2H_5OH and CH_3-O-CH_3 are isomers.

39. **(b)** 

40. **(d)** 

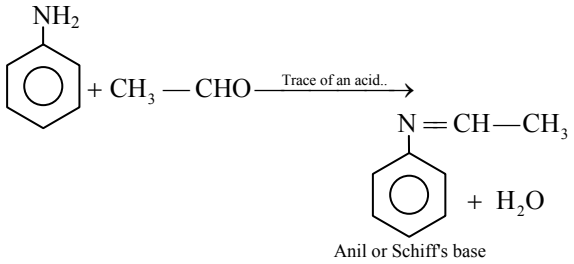
2, 2, 2, trichloroethanal

41. **(d)** $2RCOOH \xrightarrow{-H_2O} \underset{\text{Acid anhydride}}{(RCO)_2O}$

42. **(d)** 

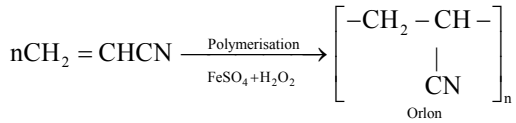
It is citric acid consist three carboxylic group.

43. **(b)** The nitro group is very firmly linked to the benzene nucleus and does not undergo any displacement reaction. Nitro group deactivates the benzene nucleus.

44. **(a)** 

Anil or Schiff's base

45. **(a)** Orlon is prepared by polymerisation of vinyl cyanide in presence of ferrous sulphate and hydrogen peroxide.



Orlon

46. **(c)** 5.3×10^{-12}

Explanation:

$[Ag^+] = 2.2 \times 10^{-4}$ mol L^{-1}

$[C_2O_4^{2-}] = 0.5[Ag^+]$

$= 0.5 \times 2.2 \times 10^{-4}$ mol L^{-1}

$= 1.1 \times 10^{-4}$ mol L^{-1}

$K_{sp} = [Ag^+]^2 [C_2O_4^{2-}]K_{sp}$

$= (2.2 \times 10^{-4}$ mol $L^{-1})^2 \times 1.1 \times 10^{-4}$ mol L^{-1}

$K_{sp} = 5.3 \times 10^{-12}$

47. **(c)** Remain the same

Equilibrium constants are not changed if you change the concentrations of things present in the equilibrium. The only thing that changes an equilibrium constant is a change of temperature.

The position of equilibrium is changed if you change the concentration of something present in the mixture. According to Le Chateliers Principle, the position of equilibrium moves in such a way as to tend to undo the change that you have made.

According to Le Chateliers Principle, if you increase the concentration of Reactant, for example, the position of equilibrium will move to the right to decrease the concentration of reactant again.

48. **(c)** 1, 4-dibromobutane

The derivative is 1, 4 dibromobutane. This on reaction with sodium metal gives cyclobutane.

49. **(b)** Ozonolysis

Ozonolysis is the cleavage of an alkene or alkyne with ozone to form organic compounds in which the multiple carbon-carbon bonds have been replaced by a double bond

to oxygen. The outcome of the reaction depends on the type of multiple bonds being oxidized.

Bromine water can be also used to identify the position of a double bond. In this reaction, red-brown colour of bromine gets turned into coulorless indicating that there is a double bond.

50. **(a)** Strongly basic

Caesium hydroxide or cesium hydroxide (CsOH) is a chemical compound consisting of caesium ions and hydroxide ions. It is a strong base (p_{kb} = -1.76), much like the other alkali metal hydroxides such as sodium hydroxide and potassium hydroxide.

❑❑❑