



## CHEMISTRY

### BOOKS - CBSE MODEL PAPER

### SAMPLE PAPER 2022

#### Section A

1. Which of the following statements is true:

- A. Melting point of Phosphorous is less than that of Nitrogen
- B.  $N_2$  is highly reactive while  $P_4$  is inert
- C. Nitrogen shows higher tendency of catenation than P
- D. N-N is weaker than P-P

**Answer:**



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2. Which of the following is a non-stoichiometric defect?

- A. Frenkel defect
- B. Schottky defect
- C. metal deficiency defect
- D. interstitial defect

**Answer:**

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3. Identify the law which is stated as:

For any solution, the partial vapour pressure of each volatile component in the solution is directly proportional to its mole fraction.

- A. Henry's law

B. Raoult's law

C. Dalton's law

D. Gay-Lussac's Law

**Answer:**



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4. Pink colour of LiCl crystals is due to:

A. Schottky defect

B. Frenkel defect

C. Metal excess defect

D. Metal deficiency defect

**Answer:**



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5. Which of the following isomer has the highest melting point:

- A. 1,2-dichlorobenzene
- B. 1,3 -dichlorobenzene
- C. 1,4-dichlorobenzene
- D. all isomers have same melting points

**Answer:**

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6. Which one of the following reactions is not explained by the open chain Structure of glucose:

- A. Formation of pentaacetate of glucose with acetic anhydride.
- B. formation of addition product with 2,4 DNP reagent
- C. Silver mirror formation with Tollen's reagent
- D. existence of alpha and beta forms of glucose.

**Answer:**



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7. Williamson's synthesis of preparing dimethyl ether is a/an

- A.  $S_N^1$  reaction
- B. Elimination reaction
- C.  $S_N^2$  reaction
- D. Nucleophilic addition reaction

**Answer:**



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8. (a) What happens when  $Cl_2$  reacts with cold dilute solution of sodium hydroxide?

(b) Why does chlorine water lose its yellow colour on standing?

- A. HCl gas is produced, due to the action of sunlight.
- B. a mixture of HOCl and HCl is produced in the presence of light
- C. HOCl and hydrogen gas is produced
- D. A mixture of HCl and  $ClO_3$  is produced, due to the action of sunlight

**Answer:**



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9. During the dehydration of alcohols to alkenes by heating with conc.

$H_2SO_4$ , the initiating step is :

- A. protonation of alcohol molecule
- B. formation of carbocation
- C. elimination of water
- D. formation of an ester

**Answer:**

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**10.** Amorphous solids are

- A. isotropic
- B. Anisotropic
- C. isotopic
- D. isomeric

**Answer:**

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**11.** Which of the following reactions is used to prepare salicylaldehyde?

- A. Kolbe's reaction

B. Etard reaction

C. Reimer- Tiemann reaction

D. Stephen's reduction.

**Answer:**

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**12.** Which of the following is an example of a solid solution?

A. sea water

B. sugar solution

C. smoke

D. 22 carat gold

**Answer:**

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13. The boiling points of alcohols are higher than those of hydrocarbons of comparable masses due to:

- A. Hydrogen bonding
- B. Ion – dipole interaction
- C. Dipole- dipole interaction
- D. Van der Waal's forces.

**Answer:**

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14. Which of the following has the lowest boiling point:

- A.  $H_2O$
- B.  $H_2S$
- C.  $H_2Se$
- D.  $H_2Te$

**Answer:**



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**15.** Which of the following statement is correct:

- A. Fibrous proteins are generally soluble in water
- B. Albumin is an example of fibrous proteins
- C. In fibrous proteins, the structure is stabilised by hydrogen bonds and disulphide bonds
- D. pH does not affect the primary structure of protein.

**Answer:**



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**16.** Major product obtained on reaction of 3-Phenyl propene with HBr in presence of organic peroxide

- A. 3- Phenyl 1- bromopropane
- B. 1 -Phenyl -3- bromopropane
- C. 1-Phenyl -2-bromopropane
- D. 3-Phenyl -2- bromopropane

**Answer:**

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17. Which of the following is a correct statement for  $C_2H_5Br$ ?

- A. It reacts with metallic Na to give ethane.
- B. It gives nitroethane on heating with aqueous solution of  $AgNO_3$
- C. It gives  $C_2H_5OH$  on boiling with alcoholic potash.
- D. It forms diethylthioether on heating with alcoholic KSH.

**Answer:**

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18. Covalency of nitrogen is restricted to:

A. 2

B. 3

C. 4

D. 5

**Answer:**



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19. Solubility of gases in liquids decreases with rise in temperature

because dissolution is an:

A. endothermic and reversible process

B. exothermic and reversible process

C. endothermic and irreversible process

D. exothermic and irreversible process

**Answer:**



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20. All elements of Group 15 show allotropy except:

A. Nitrogen

B. Arsenic

C. Antimony

D. Bismuth

**Answer:**



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21. Which of the following is a polysaccharide?

A. glucose

B. maltose

C. glycogen

D. lactose

**Answer:**

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**22. Substance having the lowest boiling point:**

A. Hydrogen

B. Oxygen

C. Nitrogen

D. Helium

**Answer:**

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**23.** Lower molecular mass alcohols are:

- A. miscible in limited amount of water
- B. miscible in excess of water
- C. miscible in water in all proportions
- D. immiscible in water

**Answer:**



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**24.** Maximum oxidation state exhibited by Chlorine is:

- A. 1
- B. 3
- C. 5

D. 7

**Answer:**



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25. In which of the following cases blood cells interior concentration (0.9%) salt will shrink:

- A. when placed in water containing more than 0.9% (mass/ volume) NaCl solution.
- B. when placed in water containing less than 0.9% (mass /volume) NaCl solution.
- C. when placed in water containing 0.9% (mass/volume) NaCl solution.
- D. when placed in distilled water.

**Answer:**



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## Section B

1. How much ethyl alcohol must be added to 1 litre of water so that the solution will freeze at  $-14^{\circ}\text{C}$ ? ( $K_f$  for water =  $1.86^{\circ}\text{C}/\text{mol}$ )

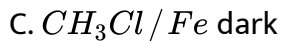
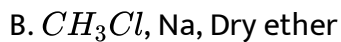
- A. 7.5 mol
- B. 8.5 mol
- C. 9.5 mol
- D. 10.5 mol

**Answer:**



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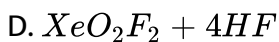
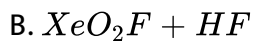
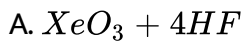
2. Which reagents are required for one step conversion of chlorobenzene to toluene?



**Answer:**

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3. On partial hydrolysis,  $XeF_6$  gives:



**Answer:**

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4. Which one of the following statement is correct about sucrose :

- A. It can reduce tollen's reagent however cannot reduce fehling's reagent
- B. It undergoes mutarotation like glucose and fructose
- C. It undergoes inversion in the configuration on hydrolysis
- D. It is laevorotatory in nature

**Answer:**



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5. Phenol does not undergo nucleophilic substitution reaction easily due to:

- A. acidic nature of phenol
- B. partial double bond character of C-OH bond

C. partial double bond character of C-C bond

D. instability of phenoxide ion

**Answer:**

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**6. Which of the following has highest ionisation enthalpy?**

A. Nitrogen

B. Phosphorus

C. Oxygen

D. Sulphur

**Answer:**

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7. Metal M ions form a ccp structure. Oxide ions occupy  $1/2$  octahedral and  $1/2$  tetrahedral voids. What is the formula of the oxide?

- A. MO
- B.  $MO_2$
- C.  $MO_3$
- D.  $M_2O_3$

**Answer:**



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8. The reaction of toluene with  $Cl_2$  in presence of  $FeCl_3$  gives 'X' while the of toluene with  $Cl_2$  in presence of light gives 'Y'. Thus 'X' and 'Y' are:

- A. X = benzyl chloride Y = o and p - chlorotoluene
- B. X = m - chlorotoluene Y = p - chlorotoluene
- C. X = o and p-chlorotoluene Y = trichloromethylbenzene

D. X= benzyl chloride, Y = m-chlorotoluene

**Answer:**

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9. Ozone is a/ an \_\_\_\_\_ molecule and the two O-O bond lengths in ozone are (i) \_\_\_\_\_-and (ii) \_\_\_\_\_

A. linear ,110pm , 148pm

B. angular, 110pm , 148pm

C. linear, 128pm , 128pm

D. angular, 128pm , 128pm

**Answer:**

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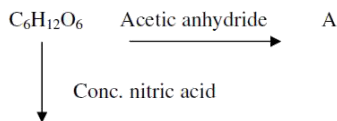
10. Water retention or puffiness due to high salt intake occurs due to:

- A. diffusion
- B. vapour pressure difference
- C. osmosis
- D. reverse osmosis

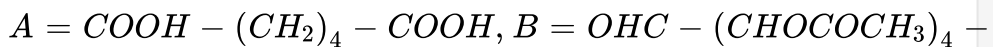
**Answer:**

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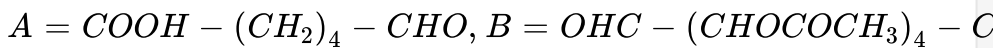
11. In the following reaction, identify A and B:



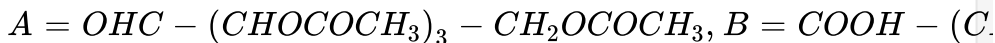
A.



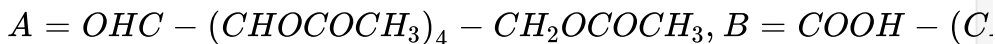
B.



C.



D.



**Answer:**



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12. In the lake test for  $\text{Al}^{3+}$  ions, there is the formation of coloured 'floating lake'. It is due to :

A. Absorption of litmus by  $[\text{Al}(\text{OH})_4]^-$

B. Absorption of litmus by  $\text{Al}(\text{OH})_3$

C. Adsorption of litmus by  $[\text{Al}(\text{OH})_4]^-$



D. Adsorption of litmus by  $Al(OH)_3$

**Answer:**

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13. A unit cell of NaCl has 4 formula units. Its edge length is 0.50 nm.

Calculate the density if molar mass of NaCl = 58.5 g/mol.

A.  $1 \text{ g/cm}^3$

B.  $2 \text{ g/cm}^3$

C.  $3 \text{ g/cm}^3$

D.  $4 \text{ g/cm}^3$

**Answer:**

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14. Which one of the following are correctly arranged on the basis of the property indicated:

- A.  $I_2 < Br_2 < F_2 < Cl_2$  [ increasing bond dissociation enthalpy]
- B.  $H_2O > H_2S < H_2Te < H_2Se$  [ increasing acidic strength]
- C.  $NH_3 < N_2O < NH_2OH < N_2O_5$  [ increasing oxidation state]
- D.  $BiH_3 < SbH_3 < AsH_3 < PH_3 < NH_3$  [increasing bond angle]

**Answer:**



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15. What would be the reactant and reagent used to obtain 2,4 - dimethylpentan-3-ol ?

- A. Propanal and propyl magnesium bromide
- B. 3-methylbutanal and 2-methyl magnesium iodide
- C. 2-dimethylpropanone and methyl magnesium iodide

D. 2- methylpropanal and isopropyl magnesium iodide

**Answer:**

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16. o-hydroxy benzyl alcohol when reacted with  $PCl_3$  gives the product as  
(IUPAC name)

- A. o- hydroxy benzyl chloride
- B. 2- chloromethylphenol
- C. o-chloromethylchlorobenzene
- D. 4-hydroxymethylphenol

**Answer:**

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17. Which of the following statements is true:

- A. Ammonia is the weakest reducing agent and the strongest base among Group 15 hydrides.
- B. Ammonia is the strongest reducing agent as well as the strongest base among Group 15 hydrides.
- C. Ammonia is the weakest reducing agent as well as the weakest base among Group 15 hydrides.
- D. Ammonia is the strongest reducing agent and the weakest base among Group 15 hydrides.

**Answer:**



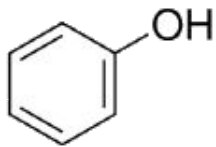
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18. Identify the secondary alcohols from the following set:

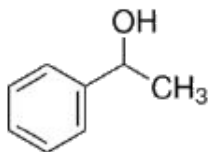


(ii)  $(C_2H_5)_3COH$

(iii)



(iv)



A. (i) and (iv)

B. (i) and (iii)

C. (i) and (ii)

D. (i), (iii) and (iv)

**Answer:**



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19. Alkenes decolourise bromine water in presence of  $CCl_4$  due to formation of:

- A. allyl bromide
- B. vinyl bromide
- C. bromoform
- D. vicinal dibromide

**Answer:**



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20. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Electron gain enthalpy of oxygen is less than that of Flourine but greater than Nitrogen.

Reason (R): Ionisation enthalpies of the elements follow the order

Nitrogen > Oxygen > Fluorine

Select the most appropriate answer from the options given below:

- A. Both A and R are true and R is the correct explanation of A
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true.

**Answer:**



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**21.** Given below are two statements labelled as Assertion (A) and Reason

(R) Assertion

(A): Alkyl halides are insoluble in water.

Reason (R): Alkyl halides have halogen attached to  $sp^3$  hybrid carbon.

Select the most appropriate answer from the options given below:

- A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

**Answer:**



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**22.** Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): Molarity of a solution changes with temperature.

Reason (R): Molarity is a colligative property.

Select the most appropriate answer from the options given below:

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.



**Answer:**



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**23.** Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A):  $SO_2$  is reducing while  $TeO_2$  is an oxidising agent.

Reason(R): Reducing property of dioxide decreases from  $SO_2$  to  $TeO_2$ .

Select the most appropriate answer from the options given below:

- A. Both A and R are true and R is the correct explanation of A
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true.

**Answer:**



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24. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Cryoscopic constant depends on nature of solvent.

Reason (R): Cryoscopic constant is a universal constant. Select the most appropriate answer from the options given below:

- A. Both A and R are true and R is the correct explanation of A
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true.

**Answer:**



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## 1. Match the following:

I	II
(i) Amino acids	(A) protein
(ii) Thymine	(B) Nucleic acid
(iii) Insulin	(C) DNA
(iv) phosphodiester linkage	(D) Zwitter ion
(v) Uracil	

Which of the following is the best matched options?

A. i-A, v- D, iii- C, iv-B

B. i-D, ii-C, iii- A, iv-B

C. i-D, v- D, iii- A, iv-B

D. i-A, ii- C, iii- D, iv-B

**Answer:**



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2. Which of the following analogies is correct:

A. Nitrogen:  $1s^2 2s^2 2p^3$  :: Argon:  $1s^2 2s^2 2p^6$

B. Carbon: maximum compounds :: Xenon: no compounds

C.  $XeF_2$ : Linear ::  $ClF_3$ : Trigonal planar

D. Helium: meteorological observations:: Argon: metallurgical processes

**Answer:**

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3. Complete the following analogy:

Same molecular formula but different structures: A: Non superimposable mirror images: B

A. A: Isomers B: Enantiomer

B. A: Enantiomers B: Racemic mixture

C. A: Stereoisomers B: Retention

D. A: Isomers B: Stereoisomers

**Answer:**



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4. Early crystallographers had trouble solving the structures of inorganic solids using X-ray diffraction because some of the mathematical tools for analyzing the data had not yet been developed. Once a trial structure was proposed, it was relatively easy to calculate the diffraction pattern, but it was difficult to go the other way (from the diffraction pattern to the structure) if nothing was known a priori about the arrangement of atoms in the unit cell. It was important to develop some guidelines for guessing the coordination numbers and bonding geometries of atoms in crystals. The first such rules were proposed by Linus Pauling, who considered how one might pack together oppositely charged spheres of different radii. Pauling proposed from geometric considerations that the quality of the "fit" depended on the radius ratio of the anion and the cation.

If the anion is considered as the packing atom in the crystal, then the smaller cation fills interstitial sites ("holes"). Cations will find arrangements in which they can contact the largest number of anions. If

the cation can touch all of its nearest neighbour anions then the fit is good. If the cation is too small for a given site, that coordination number will be unstable and it will prefer a lower coordination structure. The table below gives the ranges of cation/anion radius ratios that give the best fit for a given coordination geometry.

Coordination number	Geometry	$\rho = r_{\text{cation}}/r_{\text{anion}}$
2	linear	0 - 0.155
3	triangular	0.155 - 0.225
4	tetrahedral	0.225 - 0.414
4	square planar	0.414 - 0.732
6	octahedral	0.414 - 0.732
8	cubic	0.732 - 1.0
12	cuboctahedral	1.0

The radius of  $Ag^+$  ion is 126pm and of  $I^-$  ion is 216pm. The coordination number of  $Ag^+$  ion is:

- A. 2
- B. 3
- C. 6
- D. 8

**Answer:**



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5. Early crystallographers had trouble solving the structures of inorganic solids using X-ray diffraction because some of the mathematical tools for analyzing the data had not yet been developed. Once a trial structure was proposed, it was relatively easy to calculate the diffraction pattern, but it was difficult to go the other way (from the diffraction pattern to the structure) if nothing was known a priori about the arrangement of atoms in the unit cell. It was important to develop some guidelines for guessing the coordination numbers and bonding geometries of atoms in crystals. The first such rules were proposed by Linus Pauling, who considered how one might pack together oppositely charged spheres of different radii. Pauling proposed from geometric considerations that the quality of the "fit" depended on the radius ratio of the anion and the cation.

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4	square planar	0.414 - 0.732
6	octahedral	0.414 - 0.732
8	cubic	0.732 - 1.0
12	cuboctahedral	1.0

A solid AB has square planar structure. If the radius of cation  $A^+$  is 120pm, Calculate the maximum possible value of anion  $B^-$

- A. 240 pm
- B. 270 pm
- C. 280 pm
- D. 290 pm

**Answer:**



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6. Early crystallographers had trouble solving the structures of inorganic solids using X-ray diffraction because some of the mathematical tools for analyzing the data had not yet been developed. Once a trial structure was



proposed, it was relatively easy to calculate the diffraction pattern, but it was difficult to go the other way (from the diffraction pattern to the structure) if nothing was known a priori about the arrangement of atoms in the unit cell. It was important to develop some guidelines for guessing the coordination numbers and bonding geometries of atoms in crystals. The first such rules were proposed by Linus Pauling, who considered how one might pack together oppositely charged spheres of different radii. Pauling proposed from geometric considerations that the quality of the "fit" depended on the radius ratio of the anion and the cation.

If the anion is considered as the packing atom in the crystal, then the smaller cation fills interstitial sites ("holes"). Cations will find arrangements in which they can contact the largest number of anions. If the cation can touch all of its nearest neighbour anions then the fit is good. If the cation is too small for a given site, that coordination number will be unstable and it will prefer a lower coordination structure. The table below gives the ranges of cation/anion radius ratios that give the best fit for a given coordination geometry.

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6	octahedral	0.414 - 0.732
8	cubic	0.732 - 1.0
12	cubeoctahedral	1.0

A "good fit" is considered to be one where the cation can touch:

- A. all of its nearest neighbour anions.
- B. most of its nearest neighbour anions.
- C. some of its nearest neighbour anions.
- D. none of its nearest neighbour anions.

**Answer:**



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## Section A

1. Arrange the following in the increasing order of their property indicated

Benzoic acid, Phenol, Picric acid, Salicylic acid (pka values).

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2. Arrange the following in the increasing order of their property indicated

Acetaldehyde, Acetone, Methyl tert butyl ketone (reactivity towards  $NH_2OH$ )

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3. Arrange the following in the increasing order of their property indicated

ethanol, ethanoic acid, benzoic acid (boiling point)

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4. Solutions of two electrolytes 'A' and 'B' are diluted. The  $\Lambda_m$  of 'B' increases 1.5 times while that of A increases 25 times. Which of the two is a strong electrolyte? Justify your answer. Graphically show the behavior of 'A' and 'B'.

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5. Give reasons to support the answer:

Presence of Alpha hydrogen in aldehydes and ketones is essential for aldol condensation.

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6. Give reasons to support the answer:

3 -Hydroxy pentan-2-one shows positive Tollen's test.

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1. Account for the following

Aniline cannot be prepared by the ammonolysis of chlorobenzene under normal conditions

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2. Account for the following

N-ethylethanamine boils at 329.3K and butanamine boils at 350.8K, although both are isomeric in nature.

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3. Account for the following

Acylation of aniline is carried out in the presence of pyridine.

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4. Convert the following:

Phenol to N-phenylethanamide.

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5. Convert the following:

Chloroethane to methanamine.

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6. Convert the following:

Propanenitrile to ethanol.

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7. Answer the following questions:

a.  $[Ni(H_2O)_6]^{2+}$  is green in colour whereas  $[Ni(H_2O)_4 \cdot (en)]^{2+}$  (aq) is

blue in colour , give reason in support of your answer.

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8. Answer the following questions :

Write the formula and hybridization of the following compound:

tris(ethane-1,2-diamine) cobalt(III) sulphate

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9. In a coordination entity, the electronic configuration of the central

metal ion is  $t_{2g}^3 e_g^1$

Is the coordination compound a high spin or low spin complex?

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10. In a coordination entity, the electronic configuration of the central

metal ion is  $t_{2g}^3 e_g^1$

Draw the crystal field splitting diagram for the above complex.

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**11.** Account for the following:

Ti(IV) is more stable than the Ti (II) or Ti(III).

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**12.** Account for the following:

In case of transition elements, ions of the same charge in a given series show progressive decrease in radius with increasing atomic number.

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**13.** Account for the following:

Zinc is a comparatively a soft metal, iron and chromium are typically hard

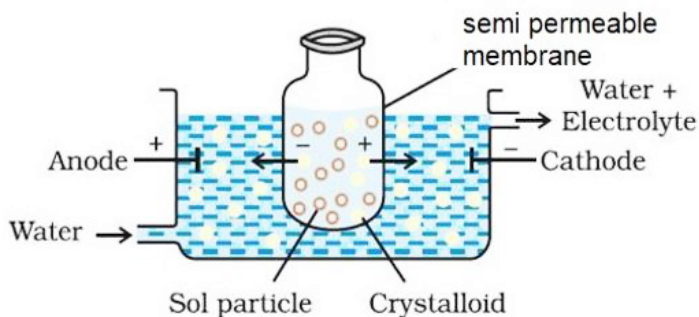
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14. An alkene 'A' (Mol. formula  $C_5H_{10}$ ) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also forms iodoform on treatment with  $I_2$  and NaOH. Compound 'C' does not give Fehling's test but forms iodoform. Identify the compounds A, B and C. Write the reaction for ozonolysis and formation of iodoform from B and C.

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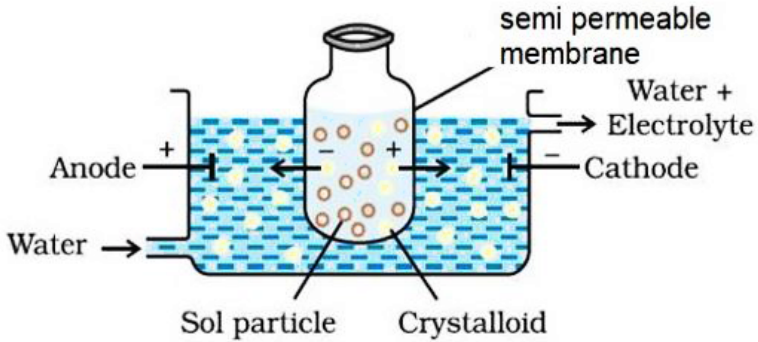
15. Observe the figure given below and answer the questions that follow:



Which process is represented in the figure?

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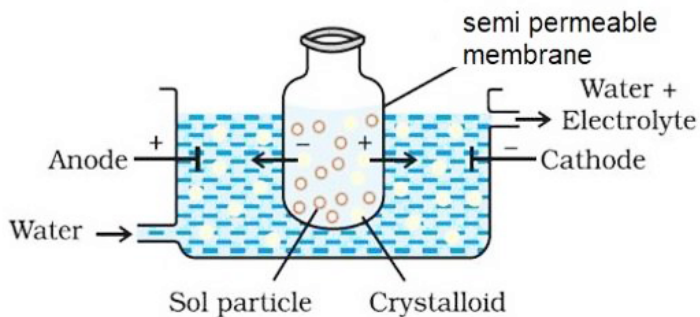
16. Observe the figure given below and answer the questions that follow:



What is the application of this process?

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17. Observe the figure given below and answer the questions that follow:



Can the same process occur without applying electric field? Why is the electric field applied?

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18. What happens when reactions:

N-ethylethanamine reacts with benzenesulphonyl chloride

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**19.** What happens when reactions:

Benzylchloride is treated with ammonia followed by the reaction with Chloromethane.

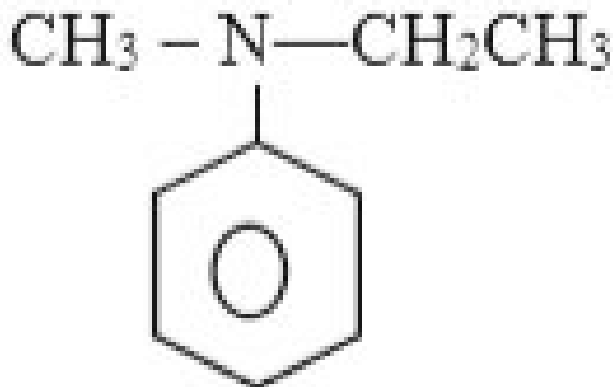
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**20.** What happens when reactions:

Aniline reacts with chloroform in the presence of alcoholic potassium hydroxide

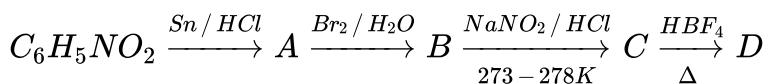
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21. Write the IUPAC name for the following organic compound:



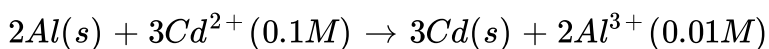
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22. Complete the following



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23. Represent the cell in which the following reaction takes place. The value of  $E^\circ$  for the cell is 1.260 V. What is the value of  $E_{\text{cell}}$  ?





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24. Why are fluorides of transition metals more stable in their higher oxidation state as compared to the lower oxidation state?



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25. Which one of the following would feel attraction when placed in magnetic field:  $Co^{2+}$ ,  $Ag^+$ ,  $Ti^{4+}$ ,  $Zn^{2+}$



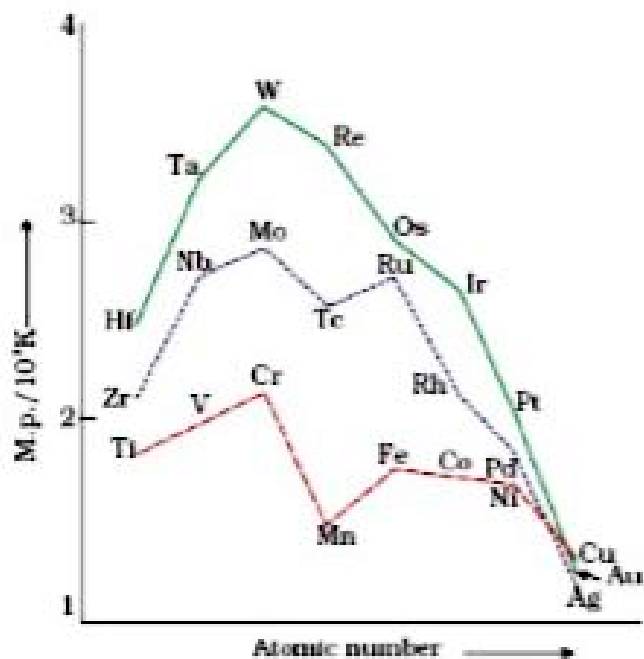
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26. It has been observed that first ionization energy of 5 d series of transition elements are higher than that of 3d and 4d series, explain why?



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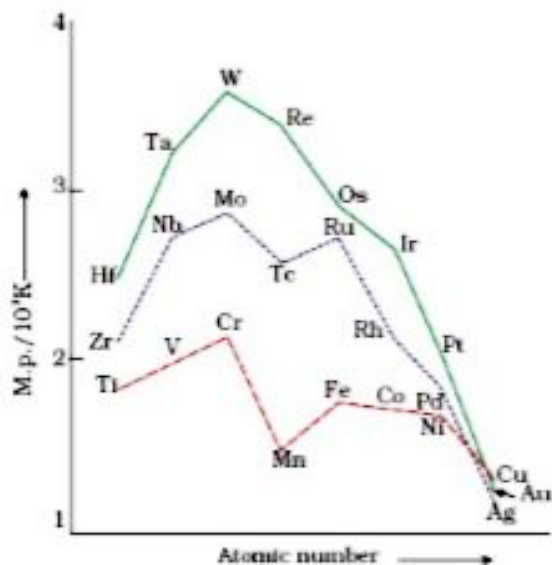
27. On the basis of the figure given below, answer the following questions:



Why Manganese has lower melting point than Chromium?

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28. On the basis of the figure given below, answer the following questions:

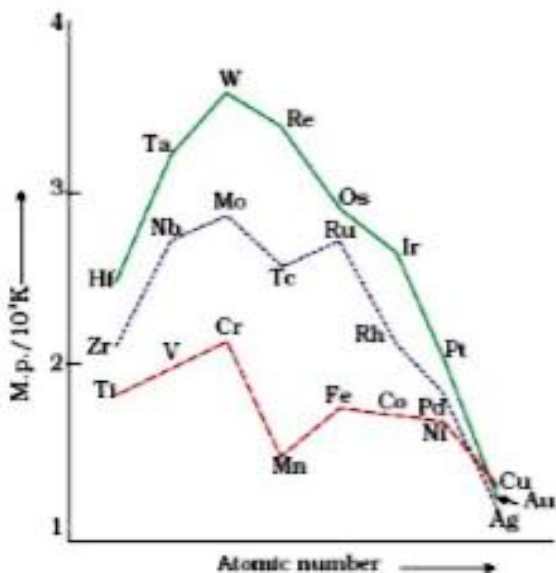


Why do transition metals of 3d series have lower melting points as compared to 4d series?

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29. On the basis of the figure given below, answer the following questions:





In the third transition series, identify and name the metal with the highest melting point.

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## Section C

1. Read the passage given below and answer the questions that follow.

Are there nuclear reactions going on in our bodies?

There are nuclear reactions constantly occurring in our bodies, but there are very few of them compared to the chemical reactions, and they do not

affect our bodies much. All of the physical processes that take place to keep a human body running are chemical processes. Nuclear reactions can lead to chemical damage, which the body may notice and try to fix.

The nuclear reaction occurring in our bodies is radioactive decay. This is the change of a less stable nucleus to a more stable nucleus. Every atom has either a stable nucleus or an unstable nucleus, depending on how big it is and on the ratio of protons to neutrons. The ratio of neutrons to protons in a stable nucleus is thus around 1:1 for small nuclei ( $Z < 20$ ). Nuclei with too many neutrons, too few neutrons, or that are simply too big are unstable. They eventually transform to a stable form through radioactive decay. Wherever there are atoms with unstable nuclei (radioactive atoms), there are nuclear reactions occurring naturally. The interesting thing is that there are small amounts of radioactive atoms everywhere: in your chair, in the ground, in the food you eat, and yes, in your body.

The most common natural radioactive isotopes in humans are carbon-14 and potassium-40. Chemically, these isotopes behave exactly like stable carbon and potassium. For this reason, the body uses carbon-14 and potassium-40 just like it does normal carbon and potassium, building

them into the different parts of the cells, without knowing that they are radioactive. In time, carbon-14 atoms decay to stable nitrogen atoms and potassium-40 atoms decay to stable calcium atoms. Chemicals in the body that relied on having a carbon-14 atom or potassium-40 atom in a certain spot will suddenly have a nitrogen or calcium atom. Such a change damages the chemical. Normally, such changes are so rare, that the body can repair the damage or filter away the damaged chemicals.

The natural occurrence of carbon-14 decay in the body is the core principle behind carbon dating. As long as a person is alive and still eating, every carbon-14 atom that decays into a nitrogen atom is replaced on average with a new carbon-14 atom. But once a person dies, he stops replacing the decaying carbon-14 atoms. Slowly the carbon-14 atoms decay to nitrogen without being replaced, so that there is less and less carbon-14 in a dead body. The rate at which carbon-14 decays is constant and follows first order kinetics. It has a half - life of nearly 6000 years, so by measuring the relative amount of carbon-14 in a bone, archeologists can calculate when the person died. All living organisms consume carbon, so carbon dating can be used to date any living organism, and any object made from a living organism. Bones, wood, leather, and even paper can be

accurately dated, as long as they first existed within the last 60,000 years.

This is all because of the fact that nuclear reactions naturally occur in living organisms.

(source: The textbook Chemistry: The Practical Science by Paul B. Kelter, Michael D. Mosher and Andrew Scott states)

Why is Carbon -14 radioactive while Carbon -12 not? (Atomic number of Carbon: 6)



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Researchers have uncovered the youngest known dinosaur bone, dating around 65 million years ago. How was the age of this fossil estimated?

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Which are the two most common radioactive decays happening in human body?



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Suppose an organism has 20 g of Carbon -14 at its time of death. Approximately how much Carbon -14 remains after 10,320 years? (Given  $\text{antilog } 0.517 = 3.289$ )



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Approximately how old is a fossil with 12 g of Carbon -14 if it initially possessed 32 g of Carbon -14? (Given  $\log 2.667 = 0.4260$ ) (1+1+1+2)



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