SECTION – I (Total Marks : 21)

(Single Correct Answer Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. Extra pure N_2 can be obtained by heating

    (A) NH_3 with CuO   (B) NH_4NO_3

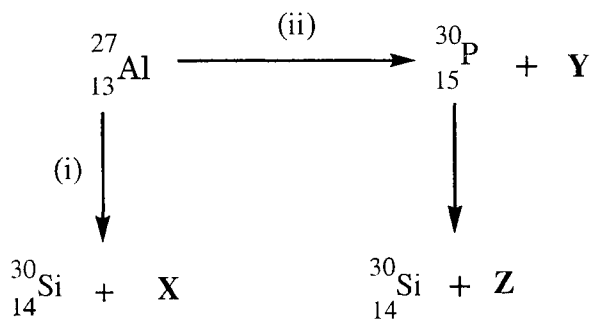   (C) $(NH_4)_2Cr_2O_7$ (D) $Ba(N_3)_2$

    ANSWER: D

2. Geometrical shapes of the complexes formed by the reaction of Ni^{2+} with Cl^-, CN^- and H_2O, respectively, are

    (A) octahedral, tetrahedral and square planar

    (B) tetrahedral, square planar and octahedral

    (C) square planar, tetrahedral and octahedral

    (D) octahedral, square planar and octahedral

    ANSWER: B

3. Bombardment of aluminum by α-particle leads to its artificial disintegration in two ways, (i) and (ii) as shown. Products **X, Y** and **Z** respectively are,

    $$^{27}_{13}Al \xrightarrow{\text{(ii)}} {}^{30}_{15}P + Y$$

    with (i) $^{27}_{13}Al \longrightarrow {}^{30}_{14}Si + X$

    and $^{30}_{15}P \longrightarrow {}^{30}_{14}Si + Z$

    (A) proton, neutron, positron   (B) neutron, positron, proton

    (C) proton, positron, neutron   (D) positron, proton, neutron

    ANSWER: A

4. Dissolving 120 g of urea (mol. wt. 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is

(A) 1.78 M   (B) 2.00 M   (C) 2.05 M   (D) 2.22 M

ANSWER: C

5. $AgNO_3$ (aq.) was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance (Λ) *versus* the volume of $AgNO_3$ is

(P)　　　　(Q)　　　　(R)　　　　(S)

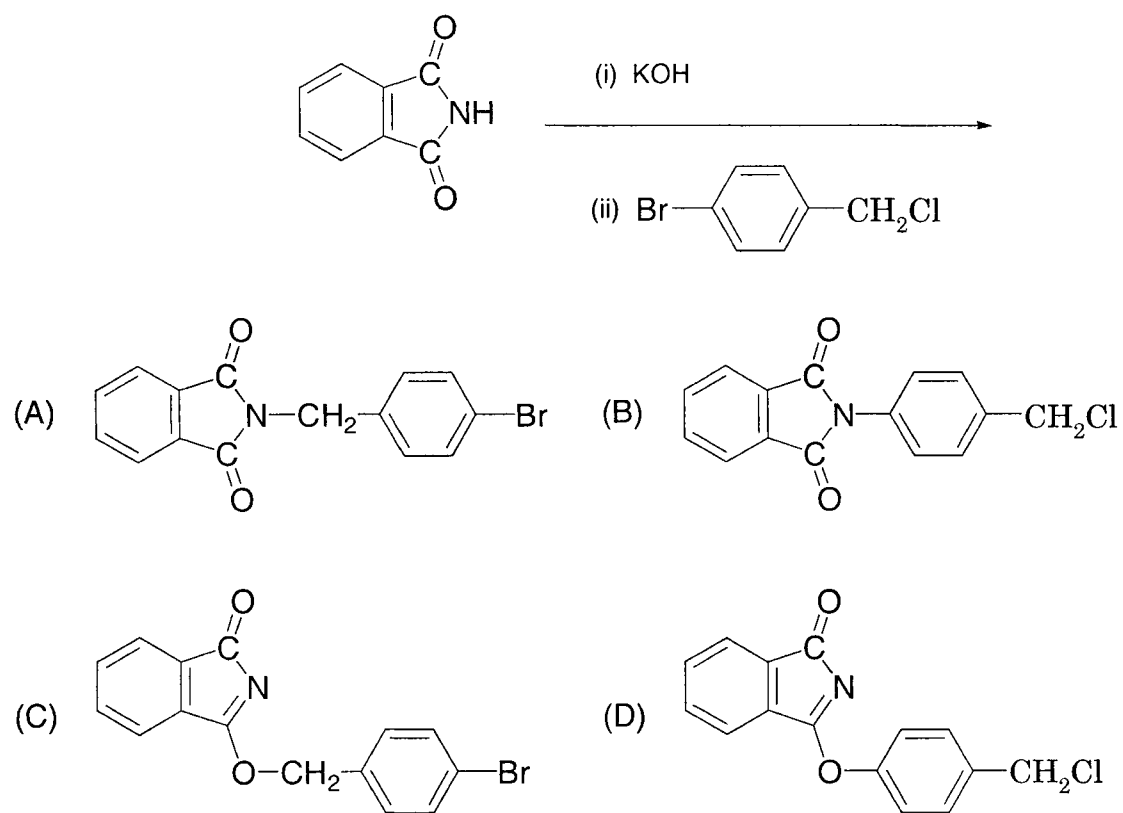(A) **(P)**   (B) **(Q)**   (C) **(R)**   (D) **(S)**
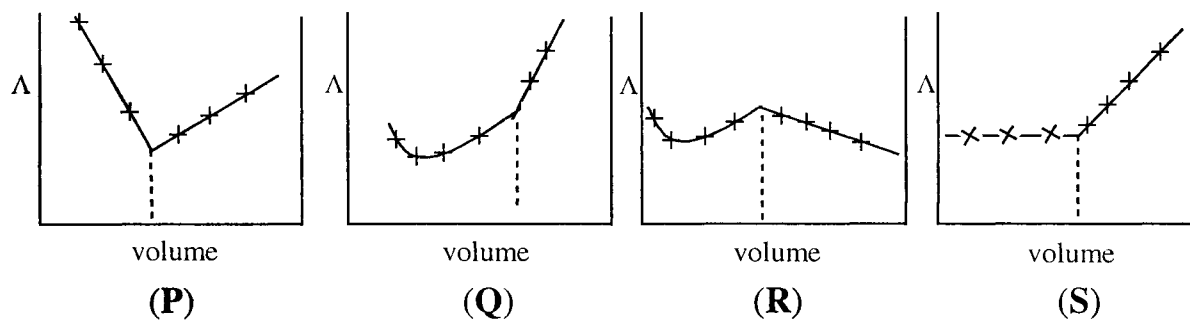
ANSWER: D

6. Among the following compounds, the most acidic is

(A) *p*-nitrophenol   (B) *p*-hydroxybenzoic acid
(C) *o*-hydroxybenzoic acid (D) *p*-toluic acid

ANSWER: C

7. The major product of the following reaction is

(i) KOH

(ii) Br—⟨ ⟩—CH₂Cl

(A)

(B)

(C)

(D)

ANSWER : A

SECTION – II (Total Marks : 16)

(Multiple Correct Answers Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** may be correct.

8.   Extraction of metal from the ore **cassiterite** involves

(A)   carbon reduction of an oxide ore   (B)   self-reduction of a sulphide ore

(C)   removal of copper impurity   (D)   removal of iron impurity
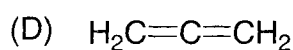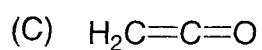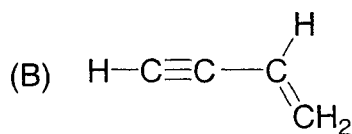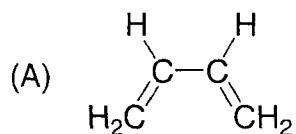
ANSWER : AD

9.   The correct statement(s) pertaining to the adsorption of a gas on a solid surface is (are)

(A)   Adsorption is always exothermic.

(B)   Physisorption may transform into chemisorption at high temperature.

(C)   Physisorption increases with increasing temperature but chemisorption decreases with increasing temperature.

(D)   Chemisorption is more exothermic than physisorption, however it is very slow due to higher energy of activation.

ANSWER : ABD

10. According to kinetic theory of gases

(A) collisions are always elastic.

(B) heavier molecules transfer more momentum to the wall of the container.

(C) only a small number of molecules have very high velocity.

(D) between collisions, the molecules move in straight lines with constant velocities.

ANSWER : ACD

11. Amongst the given options, the compound(s) in which all the atoms are in one plane in all the possible conformations (if any), is (are)

(A)
$$H_2C{=}\underset{}{C}-\underset{}{C}{=}CH_2$$
with H on top of each middle C

(B) $H{-}C{\equiv}C{-}C{\big(}^H_{CH_2}$

(C) $H_2C{=}C{=}O$

(D) $H_2C{=}C{=}CH_2$

ANSWER : BC

SECTION – III (Total Marks : 15)

(Paragraph Type)

This section contains **2 paragraphs**. Based upon one of the paragraphs **3 multiple choice questions** and based on the other paragraph **2 multiple choice questions** have to be answered. Each of these questions has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 12 to 14

When a metal rod **M** is dipped into an aqueous colourless concentrated solution of compound **N**, the solution turns light blue. Addition of aqueous NaCl to the blue solution gives a white precipitate **O**. Addition of aqueous NH_3 dissolves **O** and gives an intense blue solution.

12. The metal rod **M** is

   (A) Fe   (B) Cu   (C) Ni   (D) Co

   ANSWER : B

13. The compound **N** is

   (A) $AgNO_3$ (B) $Zn(NO_3)_2$

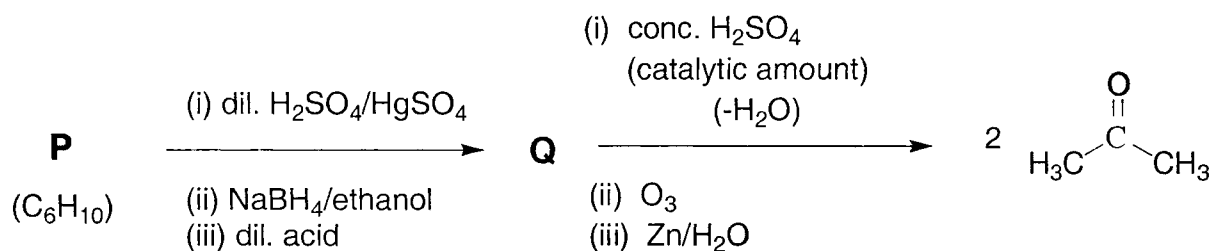   (C) $Al(NO_3)_3$ (D) $Pb(NO_3)_2$

   ANSWER : A

14. The final solution contains

   (A) $[Pb(NH_3)_4]^{2+}$ and $[CoCl_4]^{2-}$ (B) $[Al(NH_3)_4]^{3+}$ and $[Cu(NH_3)_4]^{2+}$

   (C) $[Ag(NH_3)_2]^{+}$ and $[Cu(NH_3)_4]^{2+}$ (D) $[Ag(NH_3)_2]^{+}$ and $[Ni(NH_3)_6]^{2+}$

   ANSWER : C

Paragraph for Question Nos. 15 and 16

An acyclic hydrocarbon **P**, having molecular formula C_6H_{10}, gave acetone as the only organic product through the following sequence of reactions, in which **Q** is an intermediate organic compound.

$$\textbf{P} \xrightarrow[\substack{\text{(ii) NaBH}_4\text{/ethanol} \\ \text{(iii) dil. acid}}]{\text{(i) dil. H}_2\text{SO}_4\text{/HgSO}_4} \textbf{Q} \xrightarrow[\substack{\text{(ii) O}_3 \\ \text{(iii) Zn/H}_2\text{O}}]{\substack{\text{(i) conc. H}_2\text{SO}_4 \\ \text{(catalytic amount)} \\ (-H_2O)}} 2\ \underset{H_3C}{\overset{O}{\underset{}{C}}}CH_3$$

(C$_6$H$_{10}$)

15. The structure of compound **P** is

(A) $CH_3CH_2CH_2CH_2-C{\equiv}C-H$

(B) $H_3CH_2C-C{\equiv}C-CH_2CH_3$

(C)
$$\underset{H_3C}{\overset{H_3C}{\diagdown}}\underset{\diagup}{C}-C{\equiv}C-CH_3, \quad H-$$

(D)
$$\underset{H_3C}{\overset{H_3C}{\diagdown}}\underset{\diagup}{C}-C{\equiv}C-H, \quad H_3C-$$

ANSWER : D

16. The structure of the compound **Q** is

(A)
$$\underset{H_3C}{\overset{H_3C}{\diagdown}}\underset{\diagup}{C}-\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}-CH_2CH_3, \quad H-$$

(B)
$$\underset{H_3C}{\overset{H_3C}{\diagdown}}\underset{\diagup}{C}-\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3, \quad H_3C-$$

(C)
$$\underset{H_3C}{\overset{H_3C}{\diagdown}}\underset{\diagup}{C}-CH_2\overset{\overset{OH}{|}}{C}HCH_3, \quad H-$$

(D) $CH_3CH_2CH_2\overset{\overset{OH}{|}}{C}HCH_2CH_3$

ANSWER : B

SECTION – IV (Total Marks : 28)

(Integer Answer Type)

This section contains **7 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS.

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17. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ is

ANSWER: 5

18. Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide and sodium bromate with evolution of CO_2 gas. The number of sodium bromide molecules involved in the balanced chemical equation is

ANSWER: 5

19. The maximum number of electrons that can have principal quantum number, $n = 3$, and spin quantum number, $m_s = -\frac{1}{2}$, is

ANSWER: 9

20. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕ (eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

ANSWER: 4

21. To an evacuated vessel with movable piston under external pressure of 1 atm., 0.1 mol of He and 1.0 mol of an unknown compound (vapour pressure 0.68 atm. at 0 $^\circ$C) are introduced. Considering the ideal gas behaviour, the total volume (in litre) of the gases at 0 $^\circ$C is close to

ANSWER: 7

22. The total number of alkenes possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOH is

ANSWER: 5

23. A decapeptide (Mol. Wt. 796) on complete hydrolysis gives glycine (Mol. Wt. 75), alanine and phenylalanine. Glycine contributes 47.0 % to the total weight of the hydrolysed products. The number of glycine units present in the decapeptide is

ANSWER: 6