1 Mark Questions

1. For a second order reaction $R \xrightarrow{k} P$, the relation between half-life time ($t_{1/2}$) and the initial reactant concentration $[R]_0$ is

(a) $t_{1/2} = \frac{\ln 2}{k}$ (b) $t_{1/2} = \frac{2}{k[R]_0}$

(c) $t_{1/2} = \frac{1}{k[R]_0^2}$ (d) $t_{1/2} = \frac{1}{k[R]_0}$

2. The reversible and irreversible entropy changes of a system on going from state 1 to state 2 are ΔS_{12}^{rev} and ΔS_{12}^{irrev} respectively. The correct relationship between the two entropy changes is

(a) $\Delta S_{12}^{irrev} > \Delta S_{12}^{rev}$ (b) $\Delta S_{12}^{irrev} < \Delta S_{12}^{rev}$

(c) $\Delta S_{12}^{irrev} = \Delta S_{12}^{rev}$ (d) $\Delta S_{12}^{irrev} = -\Delta S_{12}^{rev}$

3. Among the following molecules the one that is planar is

(a) $(CH_3)_3N$ (b) $[SO_4]^{2-}$

(c) $[CO_3]^{2-}$ (d) PCl_3

4. Among the following molecules the one that exhibits only one isomer is

(a) $[Fe(H_2O)_5OH]^{2+}$ (b) $Pt(NH_3)_2Cl_2$

(c) $[Pt(NH_3)_3Cl_3]^+$ (d) $[CoCl_3(NH_3)_3]$

5. The most stable carbocation among the following is

(a) $CH_3OCH_2CH_2^+$ (b) $CH_3CH{=}CHCH_2^+$

(c) $CH_3CH_2^+$ (d) $H_3C{-}\overset{\overset{O}{\|}}{C}{-}CH_2^+$

6. The carboxylic acid with the lowest pK_a value is

(a) $C_6H_5CO_2H$

(b) CH_3CO_2H

(c) p-$CH_3O{-}C_6H_4CO_2H$

(d) p-$CH_3{-}C_6H_4CO_2H$

2 Marks Questions

7. If the ground state ionisation energy of the hydrogen atom is denoted by ε then the energy required to ionise an electron from the 3rd energy level of the hydrogen atom is

(a) $\frac{2\varepsilon}{3}$ (b) $\frac{\varepsilon}{9}$

(c) $\frac{\varepsilon}{3}$ (d) $\frac{8\varepsilon}{9}$

8. Given the following standard electrode potentials at 25°C.

$\frac{1}{2}Fe^{2+} + e^- \longrightarrow \frac{1}{2}Fe(s)$; $E° = -0.440$ V

$Fe^{3+} + e^- \longrightarrow Fe^{2+}$; $E° = +0.771$ V

The standard electrode potential at 25°C for

$Fe^{3+} + 3e^- \longrightarrow Fe(s)$ is

(a) -0.036 V (b) -0.331 V

(c) -0.662 V (d) -2.422 V

9. Identify the major product Q formed in the following reaction

$$(CH_3)_2CHCH_2Br \xrightarrow[EtOH]{NaOEt} Q$$

(a) $CH_3CH(OEt)CH_2CH_3$

(b) $(CH_3)_2CHCH_2OEt$

(c) $(CH_3)_3COEt$

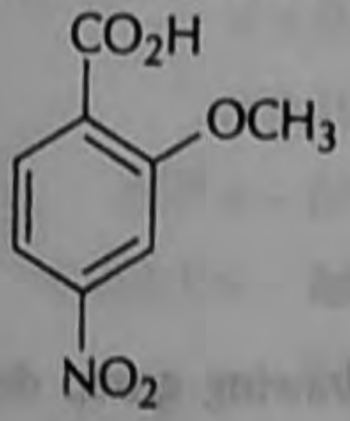
(d) $(CH_3)_2C{=}CH_2$

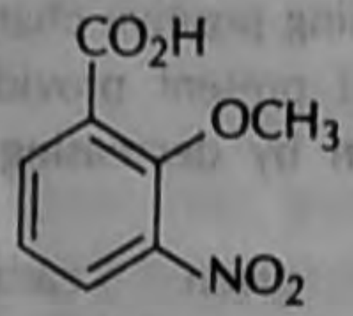
10. The reaction of $AgNO_3$ with KCl in an aqueous environment leads to an insoluble product P. Treatment of P with an excess of KCl leads to its dissolution because of the formation of Q. P and Q respectively are

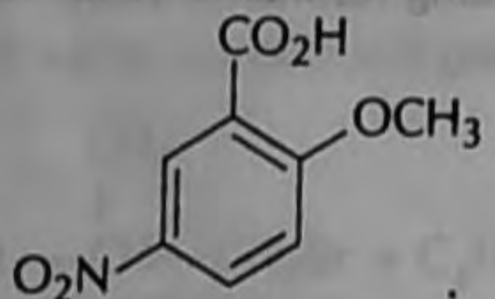
(a) AgCl and $[AgCl_2]^-$ (b) $[AgCl_2]^-$ and AgCl

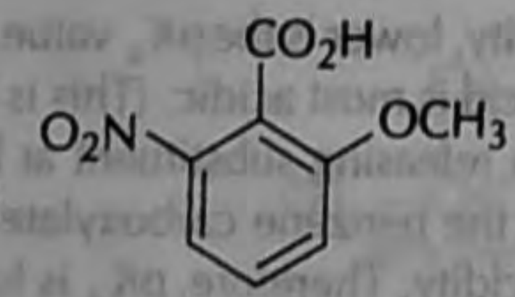
(c) AgCl and $[AgCl_3]^-$ (d) $[AgCl_2]^-$ and $[AgCl_3]^{2-}$

11. The major product formed in the nitration of *o*-methoxybenzoic acid is

(a) 

(b) 

(c) 

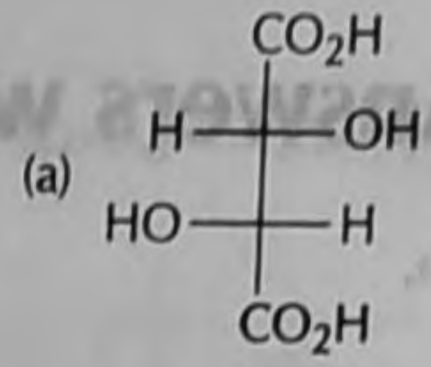
(d) 

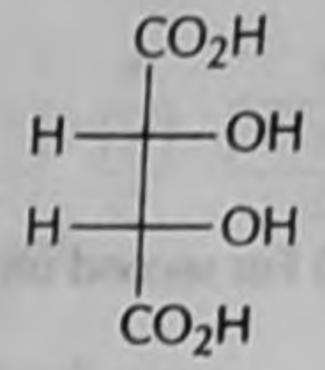
12. Match the following

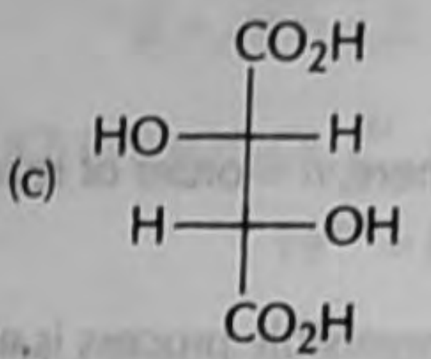
P. $[CoCl_4]^{2-}$	1. $\sqrt{15}$ BM
Q. $[Fe(H_2O)_6]^{3+}$	2. 0 BM
R. $[Fe(CN)_6]^{4-}$	3. $\sqrt{35}$ BM

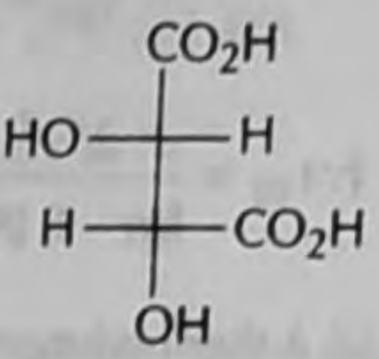
	P	Q	R
(a)	2	3	1
(b)	2	1	3
(c)	1	3	2
(d)	3	2	1

13. Which one of the following Fischer projections represents (*S*, *S*) – tartaric acid?

(a) 

(b) 

(c) 

(d) 

14. Which one among the following compounds loses a proton most readily in a basic medium?

(a) Cyclopentadiene (b) Cycloheptatriene
(c) Cyclopropene (d) 1,3-cyclohexadiene

Common Data for Questions 15 and 16

For the reaction, $P(g) \rightleftharpoons 2Q(g)$, the equilibrium constant with a standard state pressure of 1 bar is 0.25. Assume ideal gas behaviour.

15. The total pressure (in bar) needed for 50% conversion of *P* into *Q* is

(a) 0.1250 (b) 0.1875 (c) 0.5000 (d) 0.7500

16. The amount of *P* that will be converted to *Q* at a total pressure of 0.5 bar is approximately

(a) 13% (b) 25% (c) 33% (d) 55%

Statements for Linked Answer Questions 17 and 18

The reaction of BF_3 with $NaBH_4$ leads to the formation of a stable gaseous boron compound *P*. The compound *P* reacts with Me_3N to give *Q*.

17. Identify *P* among the following

(a) BH_3 (b) $Na[B_3H_8]$ (c) B_2H_6 (d) B_4H_{10}

18. The compound *Q* is

(a) $BH_3 \cdot NMe_3$ (b) $B_2H_5 \cdot NMe_3$
(c) $B_4H_9 \cdot NMe_3$ (d) $BH_3 \cdot 2NMe_3$