1 Mark Questions

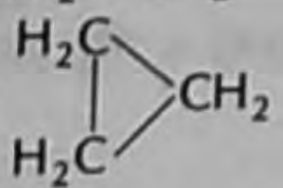
1. Which one of the following is not a state function?
(a) Enthalpy (H) (b) Internal energy (U)
(c) Work done (W) (d) Entropy (S)

2. Specify which among the following statements describe uncertainty principle?
(a) No two electrons in an atom can have the same set of four quantum numbers
(b) It is impossible to determine simultaneously the velocity and momentum of an object with certainty
(c) Matter like radiation exhibit a dual behaviour
(d) It is impossible to simultaneously determine the position and momentum of an object with certainty

3. Among the given compounds, the most stable halogen containing compound of sulphur is
(a) SF_6 (b) S_2Cl_2
(c) SF_4 (d) $SOCl_2$

4. The nucleophile among the following is
(a) BF_3 (b) SO_3
(c) $(CH_3)_3N$ (d) NO_2^+

5. In the reaction, $A + B \longrightarrow$ Products,
If the concentration of A is doubled, the rate of the reaction increases by a factor of 4.
However, if the concentration of B is doubled, the rate remains unaltered. The order of the reaction with respect to A and B will be respectively
(a) 2 and 1 (b) 2 and 0
(c) 1 and 0 (d) 1 and 1

6. The major product (X) of the reaction $BrCH_2—CH_2—CH_2Br \xrightarrow{\text{Zinc dust}}$ (X) is
(a)  (b) $CH_2=CH—CH_2Br$
(c) $BrCH_2—CH=CH_2$ (d) $CH_2=C=CH_2$

2 Marks Questions

7. Which among the following steps is not present in the determination of lattice enthalpy of NaI using the Born-Haber cycle?
(a) $\frac{1}{2}I_2(s) \longrightarrow \frac{1}{2}I_2(g)$ (b) $Na(s) \longrightarrow Na(l)$
(c) $\frac{1}{2}I_2(g) \longrightarrow I(g)$ (d) $I(g) + e^- \longrightarrow I^-(g)$

8. The boiling point of pure benzene is 80.0°C. When a certain amount of benzoic acid was added to it, the boiling point increased to 82.5°C. If the ebullioscopic constant (K_b) is 2.5 K-kg/mol, then molality of the solution will be
(a) 0.02 (b) 0.25
(c) 1.00 (d) 6.25

9. The structure of XeO_2F_2 based on VSEPR theory is best described as
(a) See-saw structure with the O—Xe—O angle close to 120°
(b) See-saw structure with F—Xe—F angle close to 120°
(c) A perfect tetrahedral arrangement of substituents around Xe
(d) A square planar structure with the fluorine *trans* to each other

10. The hydrolysis of which of the following compounds would yield phosphorous acid (H_3PO_3)?
(a) PCl_5 (b) $POCl_3$
(c) P_4O_{10} (d) PCl_3

11. The type of hybridisation that chromium shows in $Cr(CO)_6$ and $[CrF_6]^{3-}$ are respectively [Atomic number of chromium is 24]
(a) sp^3d^2 and d^2sp^3 (b) sp^3d^2 and sp^3d^3
(c) d^2sp^3 and d^2sp^3 (d) d^2sp^3 and sp^3d^2

12. Which among the following molecules has the lowest bond dissociation energy?
(a) NO (b) NO^+
(c) NO^- (d) N_2

13. A transition metal ion in its +3 oxidation state forms complexes with excess of F^- as well as Cl^-. Given that the ionic radii of the metal ion, F^- and Cl^- are 0.64, 1.34 and 1.81 Å respectively, the geometries of the metal complexes formed will be

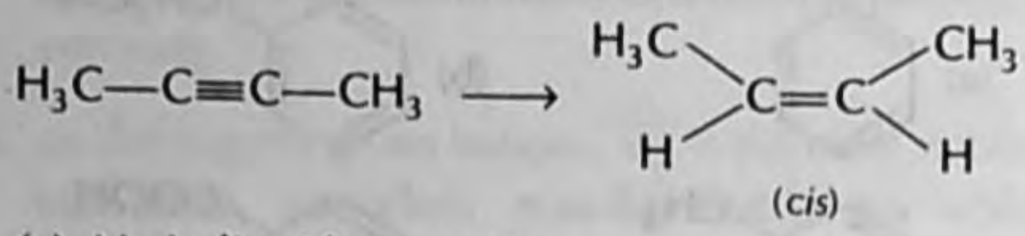
(a) $[MF_6]^{3-}$, octahedral and $[MCl_4]^-$, tetrahedral

(b) $[MF_6]^{3-}$, octahedral and $[MCl_6]^{3-}$, octahedral

(c) $[MF_4]^-$, tetrahedral and $[MCl_4]^-$, tetrahedral

(d) $[MF_4]^-$, tetrahedral and $[MCl_6]^{3-}$, octahedral

14. The reagent required for the conversion



(*cis*)

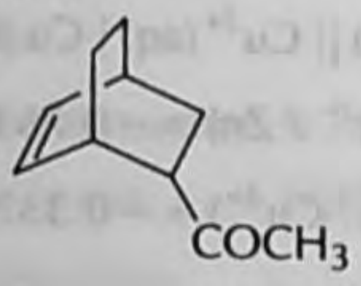
(a) Na in liquid ammonia

(b) $LiAlH_4$

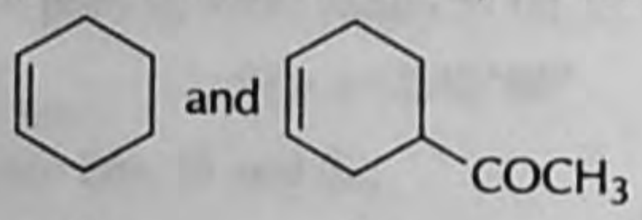
(c) Sn / HCl

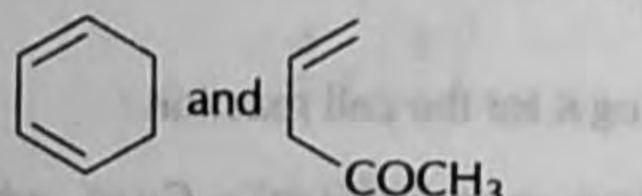
(d) Pd / $BaSO_4$/Quinoline

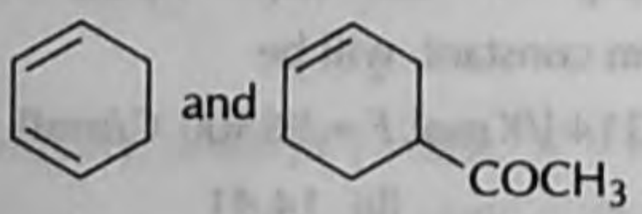
15. For the synthesis of



using Diel's-Alder reaction, the reactants required are

(a) 

(b) 

(c) 

(d) 

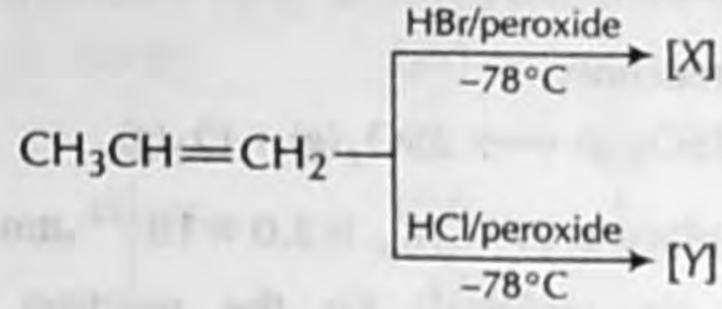
16. Match the values of K_a (given in Column 2) with the substituted benzoic acids (given in Column 1),

	Column 1		Column 2
P.	*P*—NO_2	X.	36×10^{-5}
Q.	*P*—OH	Y.	10×10^{-5}
R.	*P*—Cl	Z.	2.6×10^{-5}

(a) P-X; Q-Y; R-Z (b) P-Y; Q-X; R-Z

(c) P-Z; Q-Y; R-X (d) P-X; Q-Z; R-Y

17. The major products (*X*) and (*Y*) of the reactions



are

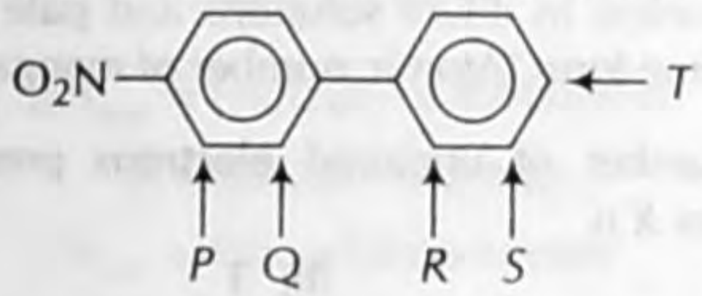
(a) $X = CH_3CHBrCH_3$; $Y = CH_3CHClCH_3$

(b) $X = CH_3CH_2CH_2Br$; $Y = CH_3CHClCH_3$

(c) $X = CH_3CH_2CH_2Br$; $Y = CH_3CH_2CH_2Cl$

(d) $X = CH_3CHBrCH_3$; $Y = CH_3CH_2CH_2Cl$

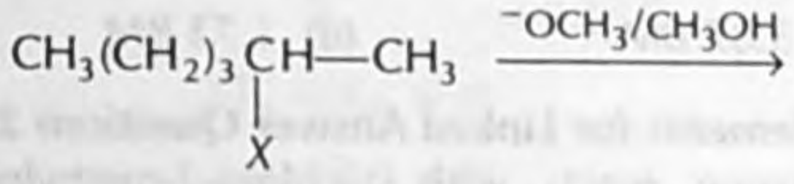
18. Nitration of *p*-nitrobiphenyl is carried out. The new nitro group would introduce at position/s



(a) *P* and *T* (b) Only *Q*

(c) *R* and *T* (d) *Q* and *S*

19. In the reaction,



If *X* = F in the first case and *X* = Br in the second case, the major product formed will be respectively

(a) 1-hexene and 1-hexene

(b) 1-hexene and 2-hexene

(c) 2-hexene and 2-hexene

(d) 2-hexene and 1-hexene

20. Henderson's equation can be represented as

(a) $pH = pK_a + \log \frac{[Acid]}{[Salt]}$

(b) $pH = pK_a + \log \frac{[Salt]}{[Acid]}$

(c) $pK_a = pH + \log \frac{[Salt]}{[Acid]}$

(d) $pK_a = pH - \log \frac{[Acid]}{[Salt]}$

21. A concentrated solution of NaCl is diluted ten times. The specific conductance (κ) and molar conductance ($\wedge_m$) will show the following behaviour

(a) decrease in κ and increase in $\wedge_m$
(b) increase in κ and decrease in $\wedge_m$
(c) no change in both
(d) increase in both

22. In the reaction,

$$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$$

taking place at 27°C, K_p is 3.0×10^{-23} atm. The value of K_c (in mol/dm^3) for the reaction is [Given $R = 0.0821 \text{dm}^3$ atm/K mol]

(a) 74×10^{-23} (b) 12×10^{-25}
(c) 5×10^{-26} (d) 2×10^{-27}

Common Data for Questions 23 and 24

$KMnO_4$ reacts with oxalic acid in the presence of excess H_2SO_4 to yield a manganese complex *X* which is colourless in dilute solutions and pale pink in the crystalline form [Atomic number of manganese is 25].

23. The number of unpaired electrons present in the complex *X* is

(a) 1 (b) 3
(c) 4 (d) 5

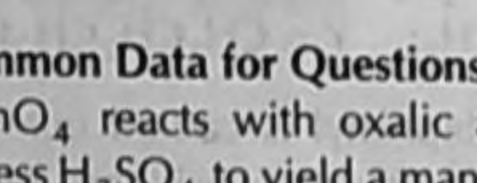
24. The calculated spin only magnetic moment for the compound *X* is

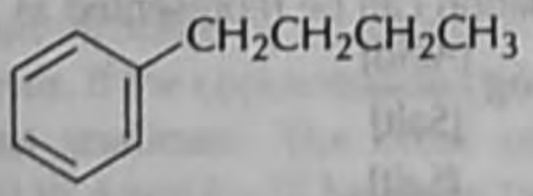
(a) 5.92 BM (b) 4.90 BM
(c) 3.87 BM (d) 1.73 BM

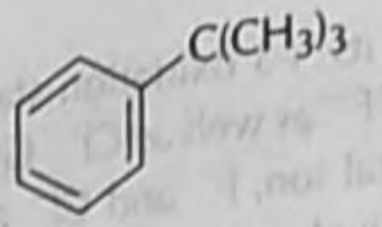
Statements for Linked Answer Questions 25 and 26

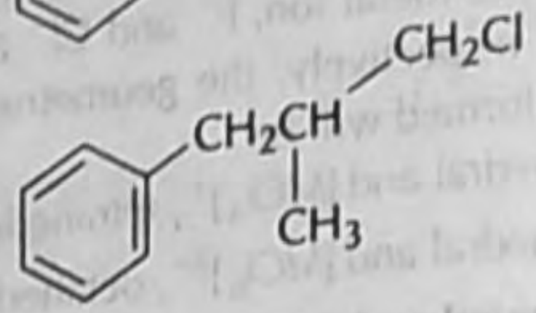
Benzene reacts with 1-chloro-2-methylpropane in presence of anhydrous $AlCl_3$ at 20°C to give major product (*X*).

25. The product (*X*) is

(a) 

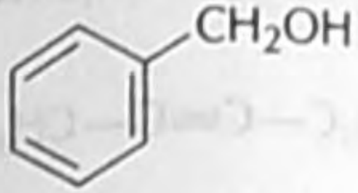
(b) 

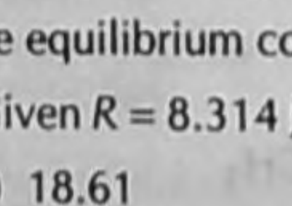
(c) 

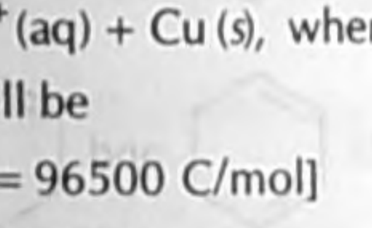
(d) 

26. Compound (*X*) on treatment with hot acidic $KMnO_4$ followed by reaction with $LiAlH_4$ gives (*Y*). Compound (*Y*) is

(a) 

(b) 

(c) 

(d) 

Statement for Linked Answer Questions 27 and 28

Consider a cell

$Zn\,(s) \mid Zn^{2+}(aq) \,||\, Cu^{2+}(aq) \mid Cu\,(s)$ operating at 298 K.

[Given, $E^\circ\,(Zn^{2+} / Zn) = -0.763$ V

and $E^\circ\,(Cu / Cu^{2+}) = -0.337$ V]

27. The emf of the cell (E°_{cell}) will be

(a) 1.100 V
(b) 0.426 V
(c) – 1.10 V
(d) – 0.426 V

28. The value of log *K* for the cell reaction :

$Zn\,(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu\,(s)$, where *K* is the equilibrium constant, will be

[Given $R = 8.314$ J/K mol, $F = 96500$ C/mol]

(a) 18.61 (b) 14.41
(c) – 14.41 (d) 37.22