

SAMPLE PAPER– I
CLASS - XI
CHEMISTRY THEORY (043)

Time: 3 Hours

Max. Marks : 70

General Instructions:

Read the following instructions carefully.

- a) There are 33 questions in this question paper. All questions are compulsory.
- b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
- c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
- d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
- e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
- f) There is no overall choice. However, internal choices have been provided.
- g) Use of calculators and log tables is not permitted.

SECTION A (OBJECTIVE TYPE)

1. Read the passage given below and answer the following questions:

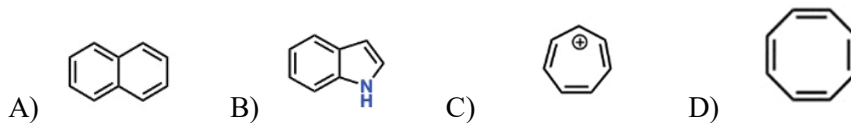
[1×4 = 4)]

A research group from Japan has made a substituted naphthalene that contains the most twisted benzene rings ever synthesised. According to Erich Hückel's 1931 rule, a molecule can only be aromatic if it has a certain number of p electrons that are delocalised around a planar ring. However, researchers have been pushing this rule to the limit by synthesising sterically hindered systems that twist aromatic rings out of planarity. Having previously discovered how to easily synthesise non-planar aromatics, Kenichiro Itami and his Nagoya University team were exploring helical molecules by fusing various aromatic rings to a central naphthalene core. When one of their reactions didn't go as planned, they found that they had made a new propeller-shaped molecule that inter converted into a twisted saddle-shaped stereoisomer when heated. With an almost 36° twist angle, this isomer's central benzene rings have a 6° higher twist angle than the previous record holder. By studying distorted aromatic systems the team hopes to ultimately develop new functional materials.

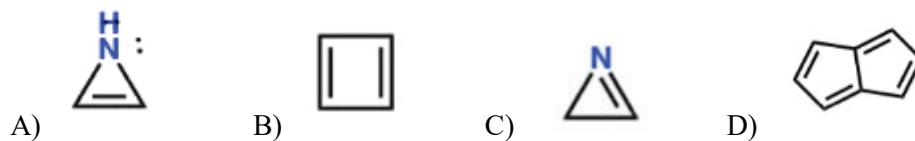
References :T Fujikawa, Y Segawa and K Itami, J. Am. Chem. Soc., 2016, 138, 3587 (DOI: 10.1021/jacs.6b01303)

The following questions are multiple choice questions. Choose the most appropriate answer:

(I) Among the following molecule the one which is not aromatic is



(II) Which of the following molecule is Non-Aromatic



OR

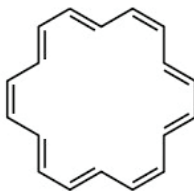
Which of the following molecule is Aromatic in nature



(III) Condition not required for the molecule to be aromatic is

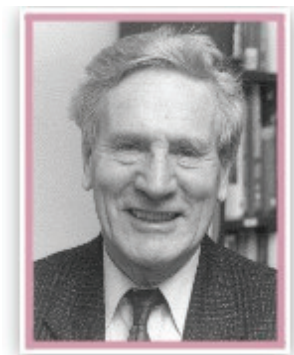
- | | |
|---------------------------|-----------|
| A) $4n+2$ π electrons | B) Cyclic |
| C) Conjugated system | D) Planar |

(IV) The compound Cyclooctadecanonaene nature is



- | | |
|-----------------|------------------------|
| A) Aromatic | B) Anitaromatic |
| C) Non-Aromatic | D) Cannot be predicted |

2. Read the passage given below and answer the following questions:
(1x4=4)



Ronald J. Gillespie



Sir Ronald Sydney Nyholm.

The Valence Shell Electron Pair Repulsion Theory :Sidgwick and Powell in 1940, proposed a simple theory based on the repulsive interactions of the electron pairs in the valence shell of the atoms. It was further developed and redefined by Nyholm and Gillespie(1957) and they put forward the concept of important difference of lone pair and the bonding pairs of electrons. While the lone pairs are localized on the central atom, each bonded pair is shared between two atoms. In the molecule the bond pair, lone pairs (if any)will occupy such position around the central atom to obtained a minimum repulsion energy states. These repulsions effects result in deviation from idealized shapes and alteration in bond angles in molecules

In these questions (Q. No V-VIII , a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
 - b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
 - c) Assertion is correct statement but reason is wrong statement.
 - d) Assertion is wrong statement but reason is correct statement.
- (V) Assertion : The shape of NH_3 is pyramidal
Reason : NH_3 contain one lone pair and three bond pair.
- (VI) Assertion : The XeF_4 molecule is tetrahedral in nature
Reason : The XeF_4 molecule has F-Xe-F bond angle as 90°
- (VII) Assertion : The central bond angle in Water is less than that of Methane.
Reason : Water molecule contain Hydrogen bonding but Methane do not.

(VIII) Assertion : The shape of XeF_6 is distorted octahedral

Reason : The XeF_6 molecule has zero lone pair and 6 bond pair.

OR

Assertion : The shape of I_3^- is linear

Reason : The lone pairs occupy the equatorial position in I_3^- .

Following questions (No. 3 -11) are multiple choice questions carrying 1 mark each

3. Which of the following option has incorrect UNIT

S.No	PARAMETER	UNIT
1	Frequency	Hz
2	Wavelength	cm^{-1}
3	Energy	eV
4	Wave number	cm^{-1}

A) Frequency

B) Wavelength

C) Energy

D) Wave number

4. Which of the following group has +R effect and -I effect

A) $-\text{CH}_3$

B) $-\text{H}$

C) $-\text{NH}_3^+$

D) $-\text{F}$

OR

Among the following group, the group having highest priority in IUPAC nomenclature scheme is :

A) $-\text{F}$

B) $-\text{OCH}_3$

C) $-\text{CH}_3$

D) $-\text{COOH}$

5. The correction factor 'a' in Vander Waal equation stands for

A) Volume

B) Pressure

C) Temperature

D) Moles

6. Which of the following molecule has coordinate bond

A) CH_4 .

B) H_2O

C) CO_2

D) NH_4^+

OR

Which molecule has zero dipole moment?

- [illegible]

7. Which of the following form is most stable for Butane

- A) Fully Staggered B) Staggered
C) Eclipsed D) Fully Eclipsed

OR

IUPAC name of product formed by oxidation using heated alkaline KMnO_4 followed by acidification of 1,2 Dimethylbenzene is

- A) 1,2 DihydroxyBenzene B) 1,2 Diethylbenzene
C) Benzene 1,2 Dicarboxylic Acid D) 2-MethylBenzoic Acid

8. Which of the following element has highest electronegativity

- A) I
B) Br
C) Cl
D) F

OR

Which block element forms the Ionic bond type compounds mainly

- A) ‘s’ B) ‘p’
C) ‘d’ D) ‘f’

9. Which of the compound is not used to remove permanent hardness

- A) Lime
B) Na_2CO_3
C) CALGON
D) ZEOLITE

10. Select the incorrect statement for the Benzene structure

- A) C-C bond length is 139 pm
B) π electron is delocalized above and below the benzene ring
C) All the carbon atom are 'sp' hybridised
D) All C-H bond are in the same plane.

11. Which of the following is heavier in weight

- A) 2g He
B) 22.4 L at STP- He
C) 20 moles H₂
D) 10 Moles N₂

In the following questions (Q. No. 12 - 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
- b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c) Assertion is correct statement but reason is wrong statement.
- d) Assertion is wrong statement but reason is correct statement.

12. Assertion : Benzene is Non-Aromatic compound

Reason : Compound which follows Huckel's rule are Aromatic in nature

13. Assertion : Boric acid is a weak acid

Reason : It releases its H^+ with difficulty.

14. Assertion : NH_3 is a Lewis Base

Reason : NH_3 molecule is pyramidal in shape.

OR

Assertion: CO molecule can act as poisonous gas

Reason : CO molecule can bind with metal

15. Assertion: Cis-But-2-ene is more polar than Trans-But-2-ene.

Reason : Trans-But-2-ene has higher melting point than Cis-2-But-2-ene.

16. Assertion : CH_4 can be prepared by Kolbe's electrolytic process

Reason : Even number alkane can be prepared in Kolbe's Electrolytic process generally.

SECTION-B

The following questions, Q.No. 17 – 25 are short answer type and carry 2 marks each.

17. Answer the following :

- a) Draw the Newman and Sawhorse structure of Butan-2-ol
- b) Illustrate with the help of one chemical test how you will distinguish between ethene and ethane

OR

Explain the following :

(i) Kolbe's Electrolysis

(ii) Wurtz Reaction

18. (i) Arrange the following type of radiations in increasing order of frequency

Radiation from microwave oven, Amber light from traffic signal, Cosmic rays from outer space, X- Ray, Radiation from FM radio

(ii) How many electrons in an atom of Na ($Z=11$) have $n=2, l=1, m_l=0, m_s=+1/2$

19. Answer the following :

(i) Draw the shape of (a) ClF_3 (b) XeF_4

(ii) Why He_2 does not exist, give reason based on Molecular Orbital Theory

OR

(i) Explain why O_2 is paramagnetic on the basis of Molecular Orbital Theory. (ii) Why H_2O is liquid but H_2S is gas.

20. The uncertainty in the momentum of a particle is $2.5 \times 10^{-14} \text{ g cm s}^{-1}$, with what accuracy can its position be determined ? ($h = 6.25 \times 10^{-27} \text{ g cm}^2 \text{ s}^{-1}$)

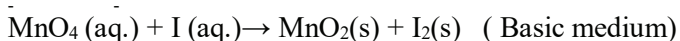
OR

What will be the wavelength of the emitted radiations when an electron jumps from a third orbit to a first orbit in a hydrogen atom ? Rydberg constant, $R = 109677 \text{ cm}^{-1}$.

21. The molar heats of combustions of $\text{C}_2\text{H}_2(\text{g})$, $\text{C}(\text{Graphite})$ and $\text{H}_2(\text{g})$ are 310.62 kcal , 94.05 kcal and 68.32 kcal respectively. Calculate the standard heat of formation of $\text{C}_2\text{H}_2(\text{g})$.

22. Explain with the help of reactions how the presence of 'N' can be detected by 'Lassaigne's Test'

23. Balance the following redox reaction by ion-electron or oxidation number method.



24. Explain the following reaction with the help of suitable example

A) Hydrogenation of Alkene

B) Dehalogenation Reaction

25. Explain the effect of following on the reaction $\text{N}_2(\text{gas}) + 3\text{H}_2(\text{gas}) \rightleftharpoons 2\text{NH}_3(\text{gas})$

(a) Addition of $\text{HCl}(\text{gas})$

(b) Addition of NH_3 gas

SECTION-C

Q.No. 26-30 are Short Answer Type II carrying 3 mark each.

26. Arrange the following :

- (a) CaH_2 , BeH_2 and TiH_2 in order of increasing electrical conductance
- (b) LiH , NaH and CsH in order of increasing ionic character
- (c) H-H , D-D and F-F in order of increasing bond dissociation enthalpy.

OR

Arrange the following :

- (a) F , Cl , Br , I in order of increasing electronegativity
- (b) Al^{3+} , Mg^{2+} , Na^+ , F^- in order of increasing ionic size.
- (c) Be , B , C , N , O in order of increasing ionization potential.

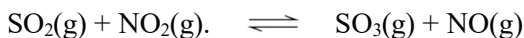
27. Arrange the following in increasing order of property specified:

- (a) $\text{CH}_2=\text{CH}_2$, $\text{CH}_3\text{CH}=\text{CH}_2$, $\text{CH}_3\text{CH}=\text{CHCH}_3$ in order of increasing rate of reaction with HBr .
- (b) Cl_3CCOOH , Cl_2CHCOOH , ClCH_2COOH in increasing order of acidic strength.
- (c) 1-MethylBenzene, Anisole, Acetophenone increasing rate of Electrophilic Aromatic chlorination substitution reaction.

OR

A hydrocarbon 'A', adds one mole of hydrogen in presence of Platinum catalyst to form n-Hexane. When 'A' is oxidized vigorously with KMnO_4 , a single carboxylic acid containing three carbon atoms is isolated. Give the structure of A and write the reaction involved.

28. At a certain temperature the equilibrium constant (K) is 16 for the reaction



If the container contain 1M concentration of each component initially, then what is the concentration of SO_2 at the equilibrium.

29. Which of the following compound will shows geometrical isomerism. Write the 'cis' and 'trans' form (if exist) for the compound.

- a) Propene
- b) But-2-ene
- c) 1, 2 Dichloroethene

30. What happens when

- (a) Magnesium is burnt in air
- (b) Quick lime is heated with silica
- (c) Calcium Nitrate is heated

SECTION-D

Q.No. 31 to 33 are long answer type carrying 5 marks each.

31. (a) Explain the hybridization in PCl_5 . Why PCl_5 has two types of bond length. (2+3)

(b) Calcium burns in nitrogen to produce a white powder which dissolves in sufficient water to produce a gas (A) and an alkaline solution. The solution on exposure to air produces a thin solid layer of (B) on the surface. Identify the compound 'A' and 'B'

OR

(i) Answer the following questions: (2+3)

- (a) Which one BCl_3 or TiCl_3 is more stable and why ?
- (b) Why Zn, Cd & Hg are not referred as transition elements ?

(ii) When a metal 'X' is treated with sodium hydroxide, a white precipitate [A] is obtained, which is soluble in excess of NaOH to give soluble complex [B]. Compound [A] is soluble in dilute HCl to form compound [C]. The compound [A] when heated strongly gives [D], which is used to extract metal. Identify [X], [A],[B],[C] and [D]. Write suitable equations to support their identities.

32. One mole of a hydrocarbon [A] reacts with 1 mole of bromine giving a dibromo compound[B], $\text{C}_5\text{H}_{10}\text{Br}_2$. Compound [A] on treatment with cold dilute alkaline KMnO_4 solution forms a compound,[C] $\text{C}_5\text{H}_{12}\text{O}_2$. On Ozonolysis, [A] gives equimolar quantities of CH_3COCH_3 - propanone and ethanal $-\text{CH}_3\text{CHO}$. Deduce the structure of [A] and write the corresponding reactions. (5)

OR

Give answer of following :

(i) (a) Give the stability order of the following carbocation :



(b) Out of Benzene, m- Dinitrobenzene ,toluene which will undergoes nitration most easily and why ? (ii) Explain the Markovnikov Rule with the help of one example and relevant mechanism.

33. (a) What is an empirical formula?

(b) A compound containing sodium, sulphur, hydrogen and oxygen gave the following results on analysis : Na= 14.28%, S=9.92 %, H=6.20%. Calculate the molecular formula of the anhydrous compound. If Hydrogen and Oxygen are present in the form of water of crystallization only, what is the structure of the crystalline salt ? (Molecular Weight of Crystalline Salt =322) **(1+4)**

OR

(a) Define Enthalpy of formation with one example.

(b) Calculate the C-C bond energy from the following data :



Assume C-H bond energy is 416 kJ **(1+4)**

ANSWER

1. I-D, II-C Or C III-D IV-A

2. V-A, VI-D, VII-B, VIII-C Or A

3. B

4. D or D

5. B

6. D or C

7. A or C

8. D or A

9. A

10. C

11. D

12. D