

ANNUAL EXAMINATION

CHE XI- M2.

Class 11 - Chemistry

Time Allowed: 3 hours

Maximum Marks: 70

General Instructions:

1. There are 35 questions in this question paper with internal choice.
2. SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 7 very short answer questions carrying 2 marks each.
4. SECTION C consists of 5 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case- based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section A

1. Volume at STP, occupied by 10^{23} molecules of oxygen is _____. [1]
a) 3.72×10^3 ML b) 14.88×10^6 ML
c) 21.88×10^6 ML d) 7.44×10^3 ML
2. Consider the following reaction: [1]
 $2\text{CO}_{(g)} \longrightarrow \text{CO}_{2(g)} + \text{C}_{(s)}$
How much carbon (in g) will be produced if 20 g of CO is reacted completely?
a) 2.14 b) 2.00
c) 10.0 d) 4.28
3. Mixture X = 0.02 mole of $[\text{Co}(\text{NH}_3)_5 \text{SO}_4] \text{Br}$ and 0.02 mole of $[\text{Co}(\text{NH}_3)_5 \text{Br}] \text{SO}_4$ was prepared in 2 L [1]
solution.
1 L of mixture X + excess of AgNO_3 solution \rightarrow Y
1 L of mixture X + excess of BaCl_2 solution \rightarrow Z
Number of moles of Y and Z are
a) 0.01, 0.02 b) 0.02, 0.02
c) 0.02, 0.01 d) 0.01, 0.01
4. If the concentration of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in blood is 0.9 g L^{-1} , what will be the molarity of glucose in blood? [1]
a) 5 M b) 0.5 M
c) 0.005 M d) 50 M
5. Which of the following visible light has the shortest wavelength? [1]

a) Green b) Yellow

c) Orange d) Indigo

6. The atom having the valence shell electronic configuration $4s^2 4p^2$ would be in: [1]

a) group II A and period 3 b) group IV A and period 3

c) group II B and period 4 d) group IV A and period 4

7. The number of types of bonds between two carbon atoms in calcium carbide is [1]

a) Two sigma, two pi b) One sigma, one pi

c) Two sigma, one pi d) One sigma, two pi

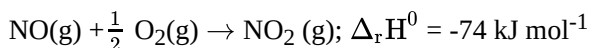
8. In thermodynamics, a process is called reversible, when: [1]

- i. surrounding and system change into each other
- ii. there is no boundary between system and surroundings
- iii. the surroundings are always in equilibrium with the system
- iv. the system changes into the surroundings spontaneously

a) Option ii b) Option iv

c) Option i d) Option iii

9. Comment on the thermodynamic stability of NO(g), Given: [1]



a) NO(g) is unstable, but NO₂(g) is formed b) NO₂(g) is unstable, but NO(g) is formed

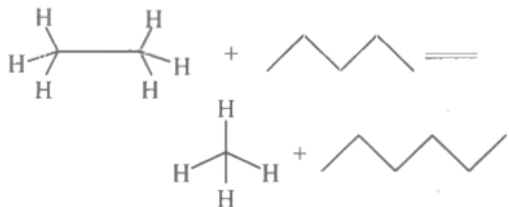
c) NO₂(g) is stable, but NO(g) is formed d) NO(g) is stable, but NO₂(g) is formed

10. A quantity of PCl₅ was heated in a 10 litre vessel at 250°C to show $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$. At equilibrium [1]
the vessel contains 0.1 mole of PCl₅, 0.20 mole of PCl₃ and 0.20 mole of Cl₂. The equilibrium constant of the reaction is:

a) 0.02 b) 0.05

c) 0.04 d) 0.025

11. Consider the following homogeneous equilibrium involving gases. [1]



For this reaction, $K_p = 9.57$ at 500 K.

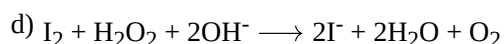
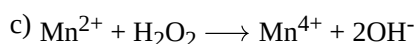
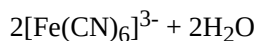
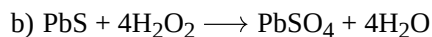
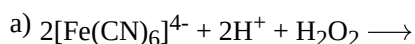
Suppose 57.5 g of each species is initially placed in a 100 decilitre reaction vessel. Which of the following is TRUE?

a) The reaction will move in backward direction to attain equilibrium. b) The reaction is at equilibrium.

c) The reaction will move in forward direction d) None of these

to attain equilibrium.

12. Which of the following equation depicts reducing nature of H_2O_2 ? [1]



13. The oxidation number of hydrogen in LiH , NaH and CaH_2 is _____. [1]

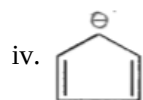
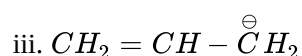
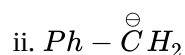
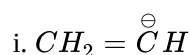
a) -1

b) -2

c) 1 and 2

d) -1 and -2

14. Arrange the following carbanions in decreasing order of stability: [1]



a) $\text{iv} > \text{ii} > \text{iii} > \text{i}$

b) $\text{i} > \text{ii} > \text{iii} > \text{iv}$

c) $\text{iv} > \text{ii} > \text{i} > \text{iii}$

d) $\text{ii} > \text{iv} > \text{iii} > \text{i}$

15. **Assertion (A):** Simple distillation can help in separating a mixture of propan-1-ol (boiling point 97°C) and propanone (boiling point 56°C). [1]

Reason (R): Liquids with a difference of more than 20°C in their boiling points can be separated by simple distillation.

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.

16. **Assertion (A):** Resonance occur in the conjugated system. [1]


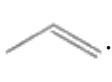
Reason (R): In resonance complete transfer of electron occur.

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.

17. **Assertion (A):** Addition of HCl on  is faster than . [1]

Reason (R): Alkene that can form more stable carbocation they have higher rate of addition with HX .

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.

18. **Assertion (A):** Nitration of benzene with nitric acid requires the use of concentrated sulphuric acid. [1]

Reason (R): The mixture of concentrated sulphuric acid and concentrated nitric acid produces the electrophile,

NO_2^+ .

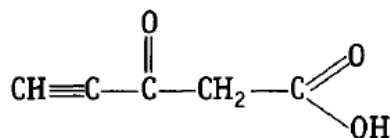
- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false. d) A is false but R is true.

Section B

19. Why N_2 is more stable than O_2 ? Explain on the basis of molecular orbital theory. [2]

OR

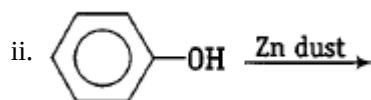
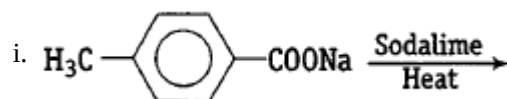
Predict the hybridisation of each carbon in the molecule of the organic compound given below. Also, indicate the total number of sigma and pi bonds in this molecule.



20. Determine the value of ΔH and ΔU for the reversible isothermal evaporation of 90.0 g of water at 100°C . [2]
Assume that water vapour behaves as an ideal gas and heat of evaporation of water is 540 cal.
($R = 2.0 \text{ cal mol}^{-1} \text{ K}^{-1}$)
21. Acetic acid (ethanoic acid) and hydrochloric acid react with KOH solution. The enthalpy of neutralisation of ethanoic acid is $-55.8 \text{ kJ mol}^{-1}$ while that of hydrochloric acid is $-57.3 \text{ kJ mol}^{-1}$. Can you think of why are these different? [2]
22. The solubility product of $\text{Fe}(\text{OH})_3$ is 1×10^{-36} . What is the minimum concentration of OH^- ions required to precipitate $\text{Fe}(\text{OH})_3$ from a 0.001 M solution of FeCl_3 ? [2]
23. How would you know whether a redox reaction is taking place in an acidic/alkaline or neutral medium? [2]
24. Rotation around carbon-carbon single bond of ethane is not completely free. Justify the Statement. [2]

OR

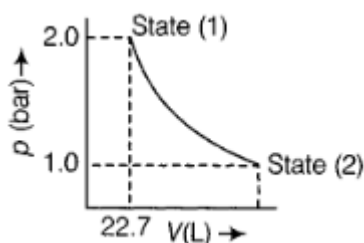
Complete the following:



25. On converting benzene to toluene, state whether there will be a rise or fall in the melting point. [2]

Section C

26. 45.4 L of dinitrogen reacted with 22.7 L of dioxygen and 45.4 L nitrous oxide was formed. The reaction is given below [3]
 $2\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{N}_2\text{O}(\text{g})$
Which law is being obeyed in this experiment? Write the statement of the law.
27. Distinguish between a photon and quantum. [3]
28. 1.0 mole of a monoatomic ideal gas is expanded from the state (1) to state (2) as shown in figure. Calculate the work done for the expansion of gas from the state (1) to state (2) at 298 K. [3]



29. The ionisation constant of dimethylamine is 5.4×10^{-4} . Calculate its degree of ionisation in its 0.02 M solution. [3]
What percentage of dimethylamine is ionised if the solution is also 0.1 M in NaOH?

OR

The concentration of sulphide ion in 0.1M HCl solution saturated with hydrogen sulphide is 1.0×10^{-19} M. If 10 mL of this is added to 5 mL of 0.04 M solution of the following: FeSO_4 , MnCl_2 , ZnCl_2 and CdCl_2 . In which of these solutions precipitation will take place?

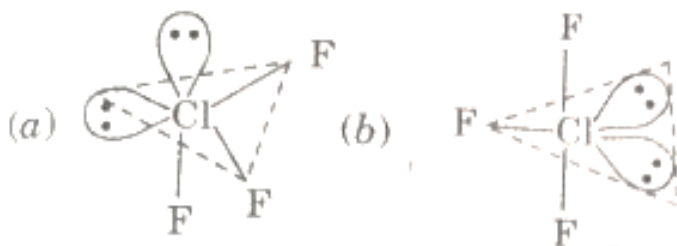
30. Suggest a method to purify [3]
i. a liquid which decomposes at its boiling point.
ii. kerosene oil containing water.
iii. camphor containing traces of common salt.

Section D

31. In order to explain the characteristic geometrical shapes of polyatomic molecules, Pauling introduced the concept of hybridisation. The orbitals undergoing hybridisation should have nearly the same energy. There are various types of hybridisations involving s, p and d-type of orbitals. The type of hybridisation gives the characteristic shape of the molecule or ion. [4]

Answer the following questions:

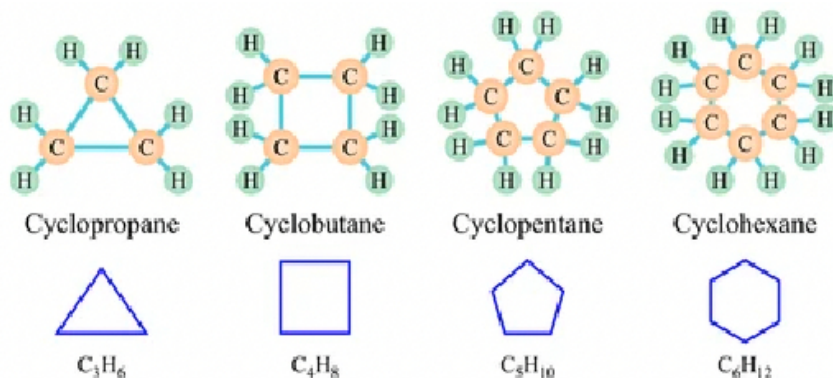
- i. The hybridised orbitals are always equivalent in _____ and _____.
ii. Out of XeF_2 and SF_2 which molecule has the same shape as NO_2^+ ion?
iii. Out of (a) and (b) given below which has correct placement of lone pairs and bond pairs.



- iv. Out of XeF_4 and XeF_2 which molecule doesn't have the same type of hybridisation as P (Phosphorus) has in PF_5 ?
v. Which of the following molecule /ion does not have same number of lone pairs?
a. SF_4
b. PH_3
c. ClO_3^-
d. XeF_2

32. Adolf von Baeyer suggested that, since carbon prefers to have tetrahedral geometry with bond angles of approximately 109° , ring sizes other than five and six may be too strained to exist. Baeyer based his hypothesis on the geometrical notion that a three-membered ring (cyclopropane) should be an equilateral triangle with bond angles to 60° , a four-membered ring (cyclobutane) should be a square with bond angles of 90° and so on. [4]

According to Baeyer's analysis, cyclopropane, with a bond angle compression of $109^\circ - 60^\circ = 49^\circ$, should have a large amount of angle strain and must, therefore, be highly reactive. Cyclohexane becomes puckered to release its strain. The angular deviation of cycloalkane is (-11°) . Greater is the angular deviation more is the torsional strain.



Answer the following questions:

- Which of the following is the most reactive cycloalkane?
Cyclopropane, Cyclobutane, Cyclopentane, Cyclohexane
- Out of Cyclopropane, Cyclobutane and Cyclopentane are the most strained cycloalkane?
- Write the tendency of Cyclopropane (I), Cyclobutane (II) and Cyclopentane (III) to form additional compounds in descending order.
- _____ has the greatest bond angle and zero strain energy. (Cyclohexane/Cyclobutane)
OR
- If the angular deviation is higher then what would be the effect on the torsional strain?

Section E

33. In the Rydberg equation, a spectral line corresponds to $n_1 = 3$ and $n_2 = 5$ [5]
- Calculate the wavelength and frequency of this spectral line.
 - To which spectral series does this line belong?
 - In what region of the electromagnetic spectrum, will this line fall?

OR

What is photoelectric effect? State the result of photoelectric effect experiment that could not be explained on the basis of laws of classical physics. Explain this effect on the basis of quantum theory of electromagnetic radiations.

34. Justify the given statement with suitable examples— “the Properties of the elements are a periodic function of their atomic numbers”. [5]
35. Draw the structure of [5]
- 2-Chlorohexane,
 - Pent-4-en-2-ol,
 - Nitrocyclohexane,
 - Benzylpent-1-ene.
 - 6-Methyl,6-Hydroxyheptanal