

HS/XI/Sc/Ch/18

2018

CHEMISTRY

(Theory)

Full Marks : 70

Time : 3 hours

General Instructions :

- (i) Write all answers in the Answer Script.
- (ii) Attempt all parts of a question together in one place.
- (iii) All questions are compulsory.
- (iv) Marks for each question are indicated against it.
- (v) Question No. **1** of Part —I is of Multiple-choice Type, each of $\frac{1}{2}$ mark. Choose and write the correct answer in the Answer Script from the four options given.
- (vi) Question Nos. **2** to **9** of Part —II are very Short-answer Type Questions of 1 mark each. Answer these either in *one* sentence or in *one* word each.
- (vii) Question Nos. **10** to **17** of Part—III are Short-answer Type—I Questions of 2 marks each. Answer these in about 20–30 words each.

- (viii) Question Nos. **18** to **26** of Part—IV are Short-answer Type—II Questions of 3 marks each. Answer these in about 40–50 words each.
- (ix) Question Nos. **27** to **29** of Part—V are Long-answer Type Questions of 5 marks each. Answer these in about 70–80 words each.
- (x) Use of ordinary Scientific Calculators and Log Tables are allowed.
- (xi) Mobile phones and Pagers are not allowed inside the Examination Hall.

PART — I

1. Choose and write the correct answers for the following in the answer script.

$$\frac{1}{2} \times 8 = 4$$

- (a) The number of molecules of O₂ present in 32 g of O₂ is:

 $\frac{1}{2}$

- (i) 6.023×10^{23}

- (ii) 6.023×10^{-23}

- (iii) 60.23×10^{23}

- (iv) 60.23×10^{-23}

(3)

- (b) One mole of methane burns in excess of air to produce CO_2 $\frac{1}{2}$
- (i) 44 g
- (ii) 22 g
- (iii) 88 g
- (iv) 11 g
- (c) Which of the following pairs represent isoelectronic $\frac{1}{2}$
- (i) F^- , Mg, Al^{3+}
- (ii) Mg^{2+} , Na^+ and Ne
- (iii) Na, Mg^{2+} and F
- (iv) Al, Ne and O^{2-}
- (d) How many electrons can fit into the orbitals that comprise the third quantum shell $n = 3$? $\frac{1}{2}$
- (i) 2
- (ii) 8
- (iii) 18
- (iv) 32

(4)

- (e) The outermost electronic configuration of the most electropositive element is $\frac{1}{2}$
- (i) $[\text{He}]2s^1$
- (ii) $[\text{Xe}]6s^1$
- (iii) $[\text{He}]2s^2$
- (iv) $[\text{Xe}]6s^2$
- (f) Which of the following elements has the maximum electron gain enthalpy? $\frac{1}{2}$
- (i) Oxygen
- (ii) Chlorine
- (iii) Fluorine
- (iv) Nitrogen
- (g) Beryllium shows diagonal relationship with $\frac{1}{2}$
- (i) Na
- (ii) B
- (iii) Al
- (iv) K

(5)

- h.* Which one of the following is present as an active ingredient in the bleaching powder for bleaching action? $\frac{1}{2}$
- (i) CaOCl_2
- (ii) $\text{Ca}(\text{OCl})_2$
- (iii) CaO_2Cl
- (iv) CaCl_2

PART — II

2. Why is ' π ' bond weaker than ' σ ' bond? 1
3. Write the ideal gas equation for one mole of a gas. 1
4. What is the difference between an open system and a closed system? 1
5. What is Le Chatelier's Principle? 1
6. How many σ and π bonds are present in the molecule 1
- $$\text{HC} \equiv \text{C} - \underset{\text{H}}{\underset{|}{\text{C}}} = \underset{\text{H}}{\underset{|}{\text{C}}} - \text{CH}_3$$

(6)

7. What are isomers? Give one example of functional isomerism. 1
8. State Markonikoff's rule. 1
9. Predict the shapes of 1
- (i) BF_3 and
- (ii) NH_3 on the basis of VSEPR theory.

PART — III

10. Prove that, 2
- $$\text{Molecular mass of a gas} = 2 \times \text{vapour density.}$$
11. What is Hund's rule of maximum multiplicity? Taking example of nitrogen, explain. 2
12. What is meant by diagonal relationship in the periodic table? What it is due to? 2
13. What happens when CO_2 is passed through lime water for long? Give equation. 2

(7)

Either

14. What is dry ice? Why is it so called? 2

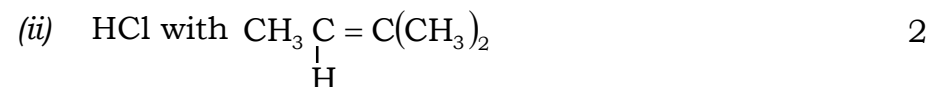
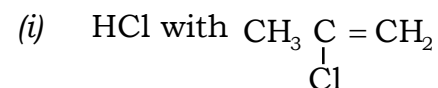
Or

What are silicones? State their uses. 2

15. What is allotropy? Name two elements which exhibit allotropy. 2

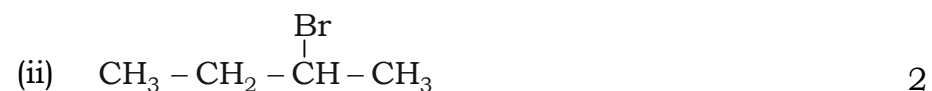
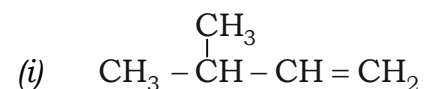
Either

16. Using Markownikov's rule predict the product of the following reactions:



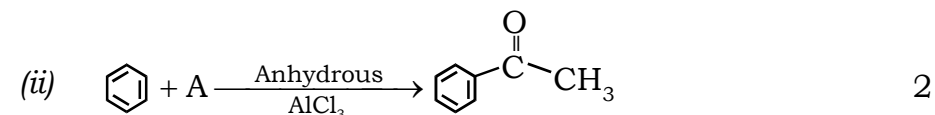
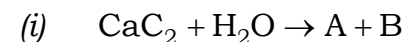
Or

Write the IUPAC names of the following compounds:



(8)

17. Complete the following reactions:



PART — IV

18. (a) Calculate the uncertainty in velocity of a cricket ball of mass 150 g if the uncertainty in its position is of the order of 1Å . ($h = 6.62 \times 10^{-34} \text{ kg m}^2\text{s}^{-1}$). 2

(b) Calculate the number of protons, neutrons and electrons in $^{80}_{35}\text{Br}$. 1

19. (a) Explain the following giving reasons: 2

(i) The size of Cl^- ion is larger than Cl atom.

(ii) Na has lower ionization enthalpy than Mg.

(b) Define electron gain enthalpy. 1

(9)

20. (a) What is aqueous tension? 1
(b) At 25°C and 760 mm pressure a gas occupies 600 ml volume. What will be its pressure at a height, where temperature is 10°C and volume of the gas is 640 ml? 2
21. (a) Define oxidizing agent and reducing agent on the basis of electronic concept. Give one example in each case. 2
(b) Determine the oxidation number of
(i) Cr in $\text{Cr}_2\text{O}_7^{2-}$
(ii) I in KIO_3 1

Either

22. (a) Write one method of preparation of H_2O_2 2
(b) Explain why H_2O_2 is stored in coloured or plastic bottles? 1
- Or*
- (c) Give the laboratory method of preparation of hydrogen. 1
(d) What are hydrides? Name the different types of hydrides. 2

(10)

23. (a) What are boranes? Draw the structure of diborane. 2
(b) Why is AlCl_3 considered as Lewis acid? 1
- Either*
24. (a) Which aliphatic hydrocarbon series is represented by C_nH_{2n} ? Write the structural formulae of various isomers of the series with four carbon atoms. 3

Or

- (b) Explain Friedel Crafts alkylation and acylation reactions with the help of example. $1\frac{1}{2} + 1\frac{1}{2} = 3$
25. (a) Why is acid rain considered as a threat to Taj Mahal? 2
(b) What is photochemical smog? 1
26. Compare the relative stability of the following species with the help of molecular orbital theory. 3
 $\text{O}_2, \text{O}_2^+, \text{O}_2^-$

(11)

PART — V

27. (a) State first law of thermodynamics and derive its mathematical expression. 2
- (b) What are intensive and extensive properties? Give examples of each. 2
- (c) State Hess's law of constant heat summation. 1

Either

28. (a) For a reaction
 $aA + bB \rightleftharpoons cC + dD$
derive the relation $K_p = K_c(RT)^{\Delta n}$ 3
- (b) For the reaction
 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$;
the value of K_p is 3.6×10^{-2} atm at 500 K. Calculate the value of K_c for the reaction at the same temperature ($R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$). 2

Or

- (c) Define Buffer solution. Give one example each of acid buffer and basic buffer. 1 + 1 = 2
- (d) What is meant by conjugate acid base pair? 1
- (e) Define pH of a solution. What is the pH of 0.01M HCl? 2

(12)

29. (a) What is inductive effect? What is meant by +I and -I effect? 1 $\frac{1}{2}$
- (b) What are free radicals? Why are they very reactive? 1 $\frac{1}{2}$
- (c) What is hyperconjugation effect? How does it differ from resonance effect? 2
