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 ½ 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 O_2 present in 32 g of O_2 is: $\frac{1}{2}$

(i) 6.023×10^{23}

(ii) 6.023×10^{-23}

(iii) 60.23×10^{23}

(iv) 60.23×10^{-23}

(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

(e) The outermost electronic configuration of the most electropositive element is $\frac{1}{2}$

(i) $[He]2s^1$

(ii) $[Xe]6s^1$

(iii) $[He]2s^2$

(iv) $[Xe]6s^2$

(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

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) $Ca(OCl)_2$

(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

$$HC \equiv C - \underset{H}{C} = \underset{H}{C} - CH_3$$ 1

7. What are isomers? Give one example of functional isomerism. 1

8. State Markonikoff's rule. 1

9. Predict the shapes of

(i) BF_3 and

(ii) NH_3 on the basis of VSEPR theory. 1

PART — III

10. Prove that,

Molecular mass of a gas $= 2 \times$ vapour density. 2

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

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 exibit allotropy. 2

Either

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

(i) HCl with $CH_3\underset{\underset{Cl}{|}}{C}=CH_2$

(ii) HCl with $CH_3\underset{\underset{H}{|}}{C}=C(CH_3)_2$ 2

Or

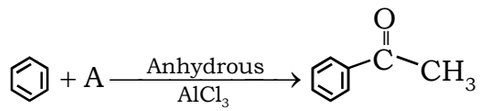
Write the IUPAC names of the following compounds:

(i) $CH_3-\overset{\overset{CH_3}{|}}{C}H-CH=CH_2$

(ii) $CH_3-CH_2-\overset{\overset{Br}{|}}{C}H-CH_3$ 2

17. Complete the following reactions:

(i) $CaC_2 + H_2O \rightarrow A + B$

(ii)  2

PART — IV

18. *(a)* Calculate the uncertainity in velocity of a cricket ball of mass 150 g if the uncertainity in its position is of the order of $1\,\mathring{A}$. $\left(h = 6.62\times10^{-34}\ \text{kg m}^2\text{s}^{-1}\right)$. 2

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

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 $Cr_2O_7^{2-}$

(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

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.

O_2, O_2^+, O_2^- 3

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 $\left(R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}\right)$. 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

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

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