Bhavan's Tripura Vidyamandir

2nd Terminal Examination : (2024-2025)

Class: -11 **Subject:-Chemistry**

Time: - 3 Hours Total: -70 Marks

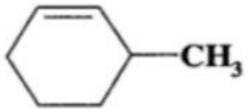
Name of the student: Roll Sec

General instructions

a. *There are 33 questions in this question paper with internal choice.*
b. *SECTION A consists of 16 multiple choice questions carrying 1 mark each.*
c. *SECTION B consists of 5 very short answer questions carrying 2 marks each.*
d. *SECTION C consists of 7 short answer questions carrying 3 marks each.*
e. *SECTION D consists of 2 case study questions carrying 4 marks each.*
f. *SECTION E consists of 3 questions carrying 5 marks each.*
g. ***All questions are compulsory**.*

SECTION A

1. Which one will have maximum number of water molecules?
   (a) 18 molecules of water (b) 1.8 grams of water
   (c) 18 grams of water (d) 18 moles of water
2. The correct order of increasing energy of atomic orbital is
   (a) 5p<4f<6s<5d (b) 5p<6s<4f<5d
   (c) 4f<5p<5d<6s (d) 5p<5d<4f<6s
3. Which one of the following is correct order of the size of iodine species?
   (a) $I > I^- > I^+$ (b) $I > I^+ > I^-$ (c) $I^+ > I^- > I$ (d) $I^- > I > I^+$
4. Which of the following is an extensive property?
   (a) Molar heat capacity (b) Temperature
   (c) Enthalpy (d) All of these
5. Which of the following is not correct?
   (a) ΔG is zero for a reversible reaction
   (b) ΔG is positive for a spontaneous reaction
   (c) ΔG is negative for a spontaneous reaction
   (d) ΔG is positive for a non-spontaneous reaction
6. For $K_p = K_c$:
   (a) Δn=1 (b) Δn>1 (c) Δn=0 (d) Δn<1
7. In which of the following equilibrium Kc and Kp are not equal?
   (a) $2C(s) + O_2(g) \rightleftharpoons 2CO_2(g)$ (b) $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$
   (c) $SO_2(g) + NO_2(g) \rightleftharpoons SO_3(g) + NO(g)$ (d) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
8. The I.U.P.A.C. name of



   (a) 3–Methyl cyclohexene (b) 1–methyl cylohex–2–ene.
   (c) 6–methyl cyclohexene (d) 1–methyl cyclohex5–ene
9. The catalyst used in Friedel–Crafts reaction is
   (a) Aluminium Chloride (b) Anhydrous Aluminium Chloride
   (c) Ferric Chloride (d) Copper
10. Which of the following substances has a dipole moment more than zero?
    (a) Water (b) Methane (c) Carbon dioxide (d) Nitrogen

11. Which of the following molecules have trigonal planar geometry?
    (a) BF_3 (b) NH_3 (c) PCl_3 (d) IF_3
    Select the most appropriate answer from the options given below.
    a. Both A and R is true and R is the correct explanations of A.
    b. Both A and R is true and R is not the correct explanations of A.
    c. A is true but R is false.
    d. A is false but R is true
12. **Assertion:** It is impossible to determine the exact position and exact momentum of an electron simultaneously.
    Reason: The path of an electron in an atom is clearly defined.
13. **Assertion:** BF3 molecule has zero dipole moment.
    Reason: F is electronegative and B–F bonds are polar in nature.
14. **Assertion:** The reaction: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
    is an example of decomposition reaction.
    Reason: Above reaction is not a redox reaction.
15. **Assertion:** Entropy of system increases for a spontaneous reaction.
    Reason: Enthalpy of reaction always decreases for spontaneous reaction.
16. **Assertion**: Trans-pent-2-ene is polar but trans-but-2-ene is non-polar.
    Reason: The polarity of cis-isomer is more than Trans which are either non-polar or less polar.

SECTION B

17. Calculate average atomic mass of carbon from following data

Isotopes	Relative abundance (%)	Atomic mass
^{12}C	98.892	12
^{13}C	1.108	13.00335
^{14}C	$2x10^{-10}$	14.00317

18. Which of the following species will have the largest and smallest size? Explain the reason.
    Mg, Mg^{2+}, Al, Al^{3+}
19. If water vapour is assumed to be a perfect gas, molar enthalpy change for vaporisation of 1 mole of water at 1 bar and 100^0C is $41KJmol^{-1}$. Calculate the internal energy change; when1 mole of water is vapourised at 1 bar pressure and 100^0C.

OR

Define molar heat capacity. Derive relation between C_p and C_v for n mole gas.

20. Give one example of redox reaction which is also a decomposition reaction and displacement reaction.
21. Write chemical equation of reaction
    (i) Nitration of benzene.
    (ii) Friedel crafts acylation of benzene.

SECTION C

22. A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gives 3.38g carbon dioxide, 0.690g of water and no other products. A volume of 10.0L (measured at STP) of this welding gas is found to weigh 11.6g. Calculate (i) empirical formula, (ii) molar mass of the gas (iii) molecular formula.

23. The quantum numbers of six electrons are given bellow. Arrange them in order of increasing energies.

i. n=4,l=2,m_l=-2,m_s=-1/2

ii. n=3, l=2, ml=1, m_s=+1/2

iii. n=4, l=1, ml=0,m_s=+1/2

iv. n=3, l=2, ml=-2, m_s=-1/2

v. n=3, l=1,m_l=-1,m_s=+1/2

vi. n=4, l=1, ml=0, m_s=+1/2

24. Compare ionisation enthalpy of

(i) Boron and beryllium

(ii) Nitrogen and oxygen.

25. For PCl_5 molecule

(i) State its hybridisation

(ii) State its geometry and shape.

(iii) Draw the shape of PCl_5 molecule.

26. (i) With the help of first law of thermodynamics and H=U+PV prove that $\Delta H=q_p$

(ii) Define specific heat capacity.

27. for the following reaction

N_2 (g) + $3H_2$ (g) $\rightleftharpoons$ 2 NH_3 (g)

(i) Write the unit of Kp and Kc.

(ii) Derive the relation between Kp and Kc.

OR

For the following reaction

H_2 (g) + I_2 (g) $\rightleftharpoons$ 2HI (g)

(i) Write the unit of Kp and Kc.

(ii) Derive the relation between Kp and Kc.

28. Write the structure of the following compound

(i) 2-chloro-4-methylanisole

(ii) 4-ethyl-2-methylaniline

(iii) 3, 4-dimethylphenol.

SECTION D

Read the following passages and answer the questions that follow:

29. We take copper sulphate solution in a beaker and put a copper strip or rod in it. Then on another breaker put a zinc sulphate solution and put a zinc rod or strip in it. Now reaction takes place in either of the breakers and at the interface of the metal and its salt solution in each beaker, both the reduced and oxidised forms of the same are present. A typical Galvanic cell is designed to make use of the spontaneous redox reaction between zinc and cupric ions to produce an electric current. This cell consists of a copper vessel. In which saturated $CuSO_4$ solution is filled which acts as a depolariser and dil. H_2SO_4 is filled which acts as an electrolyte. An amalgamated zinc rod is immersed in $ZnSO_4$. In copper vessels, there is a transparent layer all around just below the upper surface in which $CuSO_4$ crystals are kept in contact with $CuSO_4$ solution due to this the solution always remains saturated with $ZnSO_4$

(i) What is a redox couple and how to represent the above experiment as a redox couple?

(ii) Write cathode and anode reaction of the cell.

(iii) Explain the observation of the above experiment when the switch is in one position. Which species will act as an oxidant?

30. Organic reactions can be classified into four main categories. Substitution reactions, addition reactions, elimination reactions and rearrangement reactions. Substitution reactions can be further classified into free radical, nucleophilic and electrophilic substitution reactions. Addition reactions can be nucleophilic as well as electrophilic addition reactions. Dehydration, dehydrohalogenating, dehalogenation are examples of elimination reactions. Conversion by ammonium cyanate to urea is an example of rearrangement reactions. Reactions are classified on the basis to nature of intermediate species formed. Mechanism of reaction is exact path followed by the reaction involving all steps showing intermediates and slowest steps of the reaction which is rate determining step. Oxidation, reduction, combustion reactions are also important in hydrocarbons.

(i) What happens when 2-methyl propane is heated with $KMnO_4$?

(ii) What type of reaction takes place when n-hexane is heated in presence of $AICI_3$ (anhy.) and HCI?

(iii) What happens when but-2-yne reacts with H_2 in presence of Lindlar's catalyst? Write chemical equation of reaction.

SECTION E

31. (i) Write the energy and radius expression of an electron for hydrogen atom.

(ii) Calculate the energy associated with the first orbit of He^+. What is the radius of this orbit?

(iii) Write electronic configuration of nickel atom.

32. (i) Define dipole moment. Write its SI unit.

(ii) Compare dipole moment of NH_3 and NF_3

(iii) Write electronic configuration F_2 molecule.

33. (i) Write chemical equation of reaction- nitration of benzene and explain its mechanism.

(ii) Phenolic –OH is an ortho para directing group. Explain and give an example.

(iii) Write chemical equation of reaction.

(a) Chlorination of benzene in sunlight/

(b) Reduction of benzene.

OR

i) Write chemical equation of reaction- friedel crafts alkylation of benzene and explain its mechanism.

(ii) Aromatic $–NO_2$ group is a Meta directing group. Explain and give an example.

(iii) Write chemical equation of reaction.

(a) Chlorination of benzene in dark condition.

(b) Acylation of benzene.