Std. 11 Time : 3 hrs.

18-9-2015 Half Yearly Examination in CHEMISTRY M. Marks : 70

General instructions:

1. All questions are compulsory.
2. Question numbers 1 to 5 carry 1 mark each.
3. Question numbers 6 to 10 carry 2 marks each.
4. Question numbers 11 to 22 carry 3 marks each.
5. Question number 23 carries 4 marks.
6. Question numbers 24 to 26 carry 5 marks each.
7. Use log tables if required. Use of calculator is not allowed.

1. A solution is prepared by adding 2g of a substance A to 18 g of water. Calculate the mass percent of the solute. (1)

2. Differentiate between an orbit and orbital. (2 points) (1)

3. State Heisenberg's uncertainty principle. (1)

4. What is the type of hybrid orbital associated with C in C_2H_2? (Atomic number of C=6) (1)

5. Name the group reagent for group 3 cation analysis. (1)

6. Explain the shapes of H_2O and SF_6 molecules on the basis of VSEPR theory. (Atomic numbers of H = 1, O = 8, S = 16, F = 9) (2)

7. Which radical is detected by using the following reagents? (2)
   a) Nessler's reagent b) Disodium hydrogen phosphate.

8. Derive de Broglie's equation.

   (OR)

   Calculate the wavelength associated with an electron with mass 9×10^{-31}kg, moving with a velocity of 10^3 m/s, h = 6.6×10^{-3} Kg m^2s^{-1}. (2)

9. Give the test for detecting the acidic radical in carbonates. Give a chemical equation to support your answer. (2)

10. a) Which colour is observed when flame test for barium is performed?
    b) Discuss the chemistry behind the flame test. (2)

11. a) If 4g of NaOH dissolves in 36g of water, calculate the mole fraction of each component. (Atomic masses: Na = 23, O = 16, H = 1)
    b) Why do you think molality is preferred over molarity? (3)

12. A compound contains 4.07% hydrogen, 24.27% carbon, and 71.65% chlorine. Its molar

mass is 98.96g. What is its empirical and molecular formula?
(Atomic masses: C = 12, Cl = 35.5) (3)

13. What are the frequency and wavelength of a photon emitted during a transition from n = 5 to n = 2 state in the hydrogen atom? Rydberg constant = 109677 cm^{-1}, C =3 x 10^8 m/s. (3)

14. a) Give any two characteristics of s-block elements.
b) Differentiate between electron gain enthalpy and electro negativity.
c) Why F has higher electronegativity but lower electron gain enthalpy as compared to Cl?
(Atomic numbers: Cl = 17, F = 9) (3)

15. a) Give any two drawback of Mendeleev's classification of elements.
b) Why first group elements are called alkali metals?
c) Assign the position of the element having outer electronic configuration $(n-1)\ d^2\ ns^2$ for n=4. Predict whether it is a metal or a non-metal.
d) Out of Be and B which one has higher first ionization enthalpy and why?
(Atomic numbers: B = 5, Be = 4) (3)

16. a) Define the following terms:
i) Gibbs free energy ii) Enthalpy of vaporization.
b) Predict the sign of $\Delta S°$ for the following reaction and justify:
$2H_2S(g) + 3O_2(g) \rightarrow 2H_2O(g) + 2SO_2(g)$ (3)

17. a) What is a spontaneous process?
b) For the reaction, $2A(g) + B(g) \rightarrow 2D(g)$, $\Delta H° = -10.5kJ$ and $\Delta S° = -44.10J/K$ at 298 K. Calculate $\Delta G°$ for the reaction and predict whether the reaction may occur spontaneously or not. (3)

18. a) Define isoelectronic species.
b) Arrange the following in the increasing order of their size: O^{2-}, F^-, Na^+, and Mg^{2+}.
c) Discuss the periodic trend with respect to the atomic size of the elements as we move from left to right in the periodic table. (3)

19. a) Given that $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, $\Delta_r H° = -92.4kJ/mol$. What is the standard enthalpy of formation of ammonia gas?
b) Calculate the heat of reaction for the reaction,
$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$
Given: Bond enthalpies: H-H =436 kJ/mol, Br-Br = 192 kJ/mol and H-Br= 368 kJ/mol. (3)

20. a) Give reasons:
i) Endothermic reactions are favoured at high temperatures.
ii) Entropy of a crystalline solid is zero.
b) Define Hess's law of constant heat summation.
(OR)

Calculate enthalpy of formation of sucrose($C_{12}H_{22}O_{11}$)from the following data:-

$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$ $\Delta H = -5200.7$ kj/mol.

$C + O_2 \rightarrow CO_2$ $\Delta H = -395.4$ kj/mol.

$H_2 + ½\ O_2 \rightarrow H_2O$ $\Delta H = -285.8$ kj/mol. (3)

21. a) Explain why:
    i) Cations have smaller size as compared to the parent atom?
    ii) Electron gain enthalpy of O is more negative than that of N?
    iii) There are only 8 elements in the third period. (3)

22. Name the anions which are detected by the following tests:
    a) Brown ring test b) Lead acetate test
    c) Silver nitrate test. (3)

23. Rohan's mother was suffering from fever. While making lemonade for his mother, Rohan found that both salt and sugar dissolves in water. Out of curiosity he added more and more sugar to the solution and found that sugar stopped dissolving after some time.
    a) Which type of chemical compounds are in general soluble in water?
    b) Name the type of particles present in the solution salt in water.
    c) What are polar covalent compounds?
    d) What are the values shown by Rohan?

    (4)

24. a) Hydrogen reacts with Nitrogen to produce ammonia according to the equation:
    $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$
    Determine how much ammonia will be produced if 100g of N_2 reacts.
    (Atomic masses: N = 14, H = 1)
    b) With the help of an example explain the law of constant composition.
    c) 3g of H_2 react with 29g O_2 to from H_2O according to the reaction $2H_2 + O_2 \rightarrow 2H_2O$.
    i) Which is the limiting reagent?
    ii) Calculate maximum amount of H_2O formed.

    (OR)

    a) Oxygen is prepared by catalytic decomposition of potassium chlorate according to the equation:
    $2KClO_3 \rightarrow 2KCl + O_2$
    If 2.4 mol of oxygen is needed for an experiment, how many grams of potassium chlorate must be decomposed?
    (Atomic masses: K = 39, O = 16, Cl = 35.5)
    b) Calculate the percentage of O in $Fe_2(SO_4)_3$.
    (Atomic masses: Fe = 56, S = 32, O = 16)
    c) 20g of CaCO3 is treated with 20g of HCl. Calculate the mass of CO2 produced.
    $CaCO_3 + 2\ HCl \rightarrow CO_2 + H_2O + CaCl_2$

    (5)

25. a) Give reasons for the following:
    i) He_2 molecule cannot exist. (According to orbital overlap concept)
    ii) Ethyl alcohol dissolves in water.
    iii) HF is a polar molecule.
    b) Write the molecular orbital configurations of O_2^+ and O_2^- and compare their relative stabilities. (Atomic number O = 16)

(OR)

    a) Write the molecular orbital configurations of N_2 and N_2^{2-}. Calculate their bond orders and predict their magnetic behaviour.
    b) Explain the formation of PCl_5 molecule on the basis of hybridization. (Atomic numbers: P = 15, Cl = 17). What is the shape of this molecule? All the P-Cl bonds in this molecule are not identical, explain. (5)

26. a) What are degenerate orbitals?
    b) Write all four quantum numbers for a 3d orbital electron.
    c) Why is the electronic configuration of N written as $2p_x^1 2p_y^1 2p_z^1$ and not as $2p_x^2 2p_y^1$?
    d) Write the electronic configuration of Fe^{2+}(26).
    e) Draw probability distribution curve 2S electrons.

(OR)

    a) Arrange the following orbital's in the increasing order of energy.
    5p, 4d, 5d, 4f, 6s
    b) i) Write the designation of an orbital with n = 4, l = 3, m = 0, s =1/2.
    ii) How many sub shells are associated with n = 4?
    c) State Pauli's exclusion principle.
    d) Write the electronic configuration of Cu^+(29).
    e) Draw probability distribution curve 1s electrons. (5)

-x-x-x-x-x-x-x-