Indian School Al Wadi Al Kabir
Assessment 1
Chemistry (Code: 043)

Class : XI   Time: 3 Hours
Date : 18/09/2022   Max. Marks : 70

General Instructions:
1. All questions are compulsory.
2. Section A: Question nos. 1 to 10 are very short answer and Objective type questions and carry 1 mark each.
3. Section B: Questions nos. 11 to 15 are assertion-reason type questions and each question carry one mark
4. Section C: Question no. 16 consists of sub division questions based on the passage. Each subdivision question carries one mark.
5. Section D: Question nos. 17 to 23 are short answer type I questions and carry 2 marks each.
6. Section E: Question nos. 24 to 30 are short answer type II questions and carry 3 marks each
7. Section F: Question nos. 31 to 33 are long answer type questions and carry 5 marks each
8. Use of calculators is not allowed.
9. There is no overall choice in the question paper. However internal choices are given in the sections.

Section A
Questions 1 to 10 are multiple choice questions:

1. How many moles of water are produced when 20 g of hydrogen gas is burned in excess oxygen?   (1)

    a) 10 mol b) 5 mol c) 180 mol d) 2.5 mol

2. The mass percentage of Hydrogen in sulphuric acid is …………   (1)

    a) 30.44 % b) 46.56 % c) 2.05 % d) 80.20 %

3. Which of the following does not have a unit?   (1)

    a) Mole fraction   b) Molality   c) Molarity d) None of these

4. The empirical formula of C_2H_5OH is   (1)
        (a) CHO_2 b) C_2H_6O c) C_2H_2O d) $C_2H_4O_2$

5. 211.6 pm is the radius of the fourth stationary state of ………….

    (1)

    a) H atom b) He^+ ion c) Li^{2+} ion d) Be^{3+} ion

6. d sub-shell can accommodate a maximum of ……… electrons and it contains ……. orbitals. (1)

   a) 10, 20 b) 14, 7 c) 10, 5 d) 6, 3

7. Hund's Rule of Maximum Multiplicity states that (1)

   (a) No two electrons in an atom can have the same set of four quantum numbers.
   (b) Pairing of electrons does not take place until all the orbitals are singly occupied.
   (c) Only two electrons may exist in the same orbital and these electrons must have opposite spin.
   (d) In the ground state of the atoms, the orbitals are filled in order of their increasing energies.

8. How many electrons in an atom can have the following quantum numbers? (1)

   $n = 4, l = 2, m_l = -1$

   a) 6

   b) 3

   c) 2

   d) 4

9. IUPAC name and symbol of an element with atomic number 103 is (1)

   a) Unnilheptium, Unh

   b) Unniltrium, Unt

   c) Nilunennium, Nue

   d) Ununtrium, Unt

10. The general outer electronic configuration of f block elements is ………. (1)

    a) $(n\text{-}2)f^{1\text{-}14}(n\text{-}1)d^{1-10}ns^2$
    b) $(n\text{-}1)f^{1\text{-}14}(n\text{-}1)d^{0-1}ns^2$
    c) $(n\text{-}2)f^{1\text{-}14}(n\text{-}1)d^{0-1}ns^{0\text{ to }2}$
    d) $(n\text{-}2)f^{1\text{-}14}(n\text{-}1)d^{0-1}ns^2$

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Section B

Questions 11 to 15 are Assertion and reason type Questions:

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
(C) Assertion is correct, but reason is wrong statement.
(D) Assertion is wrong, but reason is correct statement.

11. Assertion: The empirical formula of Ethane is CH_2 (1)

    Reason: The empirical formula represents the simplest whole number ratio of various atoms present in a compound

12. Assertion: In the ground state, nitrogen atom contains 3 unpaired electrons in its 2p sub-shell. (1)
    Reason: Pairing of electrons does not take place until all the orbitals are singly occupied.

13. Assertion: Azimuthal quantum number of the outermost electron of aluminium is 2 (1)

    Reason: Outermost electron of aluminium is in 3p sub-shell.

14. Assertion (A): Combustion of 16 g of methane gives 18 g of water. (1)
    Reason (R): In the combustion of methane, water is one of the products.

15. Assertion: Helium is placed in group 18 along with p-block elements. (1)
    Reason: It shows properties similar to p-block elements.

Section C

16.

Read the passage given below and answer the following questions. (1 x 5 = 5)

Orbitals of electrons in atoms differ in size, shape and orientation. Definite energies and angular movements characterize atomic orbitals. The state of an electron in any atom is defined by certain permissible values of energy and angular momentum, which describe its location with respect to its nucleus and its energy level. These permissible states are called orbitals and are expressed by a set of four numbers 'n', $'l'$, 'ml' and 'ms' called quantum numbers. These numbers serve as the signature of the electrons, uniquely describing its position in the atom. The 'n', $'l'$ and 'ml' indicate the spatial distribution while 'ms' indicates the spin orientation of the electrons.

i. Which of the following sets of quantum numbers are not possible?
   a. n = 1, l = 0, ml = 0, ms = - ½
   b. n = 5, l = 1, ml = -1, ms = + ½
   c. n = 2, l = 2, ml = 0, ms = + ½
   d. n = 4, l = 3, ml = -2, ms = - ½

ii. The magnetic quantum number of an atom is related to the
    a. size of the orbital
    b. spin angular momentum

c. orbital angular momentum

d. orientation of the orbital in space

iii. The maximum number of electrons that can be accommodated in any orbital is

   a. 6

   b. 2

   c. 10

   d. 14

iv. Which among the following orbitals has the highest energy?

   a. 2p

   b. 3s

   c. 4s

   d. 3d

v. For principal quantum number, n = 4, the total number of orbitals having $l = 3$ is

   a. 3

   b. 9

   c. 5

   d. 7

Section D

17. 12 g of Mg is burnt in a closed vessel which contains 4 g of Oxygen according to the equation

$$2\ Mg + O_2 \longrightarrow 2MgO$$

Which out of the reactants is excess in amount? Show the working.   (2)

(Atomic mass of Mg = 24u, O=16 u)

18. If 4 g of NaOH dissolves in 36 g of H_2O, calculate the mole fraction of each component in the solution.   (2)

19. State Law of multiple proportion with an example   (2)

20. Give the mathematical expression of Heisenberg's uncertainty principle. Indicate the meaning of each term used in the equation   (2)

OR

Which quantum number determines.

(i) energy of electron

(ii) Orientation of orbitals.

21. Show the distribution of electrons in an oxygen atom (atomic number 8) using an orbital diagram.   (2)

OR

Nickel atom can lose two electrons to form Ni²+ ion. The atomic number of nickel is 28.

    (i)   Write the electronic configuration of Nickel atom

    (ii)   From which orbital will nickel lose two electrons to form Ni^{2+}

22. Calculate the total number of angular nodes and radial nodes present in the 3p orbital   (2)

23. Give two points of difference between s and p block elements.   (2)

Section E

24. State : (3)

    (a) Aufbau principle
    (b) n+l rule
    (c) Pauli's exclusion principle

25. Calculate the uncertainty in the velocity of the cricket ball of mass 100 g if the uncertainty in its position is 1 A^0 (3)

    (Planck's constant h= 6.626 x 10^{-34} kgm^2s^{-1})

    OR

    What are the designated orbitals having these quantum numbers

    (i) n = 2, l = 1   (ii) n = 2, l = 0   (iii) n = 4, l = 3 (iv) n = 4, l = 2   (v) n = 4, l = 1

    (vi) n=3 l=2

26. Write the electronic configuration of (i) Mn^{2+}, (ii) Fe^{3+} (iii) Cr^{2+} and Zn^{2+} Mention the number of unpaired electrons in each case. (3)

    Mn (Z = 25)   Fe (Z = 26) Cr (Z = 24)

27. In the reaction 2A + 4B $\longrightarrow$ 3C + 4D (3)

    when 5 moles of A react with 6 moles of B

    (i)   Identify the limiting reagent
    (ii)   Calculate the amount of moles of C formed.

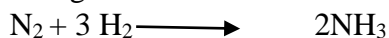28. Give three differences between Molarity and Molality (3)

29. Calculate the mass percentage of Calcium, Phosphorous and Oxygen in $Ca_3(PO_4)_2$ (3)

    Atomic mass of Ca = 40 u, P= 31 u and O= 16 u

    ## OR

    45.4 L of Nitrogen gas reacts with 22.7L of Oxygen gas to give 45.4 L of Nitrous oxide (N_2O).
    (i)   Which law is being obeyed in this experiment?
    (ii)   Write the statement of the law.
    (iii) Using this same law in the manufacture of Ammonia
           N_2 + 3 H_2 $\longrightarrow$ 2NH_3
           Find out the volume of Ammonia formed when 50 ml of Nitrogen gas reacts with 150 ml of Hydrogen gas

30. Two elements C and D have atomic numbers 16 and 19 respectively. On the basis of electronic configuration predict the following: (3)

    (i)   The group
    (ii)   period, and

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(iii)   block to which each element belongs

Section F

31. (a) An organic compound on analysis gave the following data: C= 60 %, H= 8 % and O = 32 %. Its   (5)
molar mass is 100 g. Find its empirical and molecular formula.

(b) Calculate the molarity of 49% solution of H_2SO_4 having density 9.8 g/ml

   (Atomic mass of S=32 u, O=16 u)

OR

(a) Calculate the mass of CH_4 which will react with 32 g of Oxygen as per the following
equation
$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$
(b) Calculate the mass of KOH dissolved in water to make a 1 L solution whose molarity
is 1M. (Atomic mass of K=39 u)

32. (a) Calculate the wavelength of a body of 1 g moving with a velocity of 10 m/s.   (5)

   (h=6.626 x 10^{-34} Js$^)$

(b) Write the expression for Bohr frequency rule

(c) Show that the circumference of the Bohr orbit for Hydrogen atom is an integral multiple of the
de Broglie wavelength associated with the electron revolving around the orbit.

OR

(a) Calculate the momentum of a moving particle which has a De Broglie wavelength of
6.626 x 10^{-12} m
(b) What is the frequency of a photon emitted during a transition from n=4 to n=2 state in the
Hydrogen atom?

33.
(a) Draw the shapes of the following orbitals   (5)
   (i) d_{xy} (ii) $d_z{}^2$
(b) What is the total number of orbitals associated with n=3
(c) Which one is having higher energy
(i)   Last electron of Cl^- or O^{2-}
(ii)   n=4, $l=3$ or   n=5, $l=2$

OR

(a) The energy associated with the first orbit in the Hydrogen atom is -2.18 x 10^{-18} J What is
the energy of the 5th orbit?
(b) Calculate the radius of the 5th orbit of Hydrogen atom?
(c) How many electrons will be present with $m_s = -\frac{1}{2}$ for n= 3?
(d) How many orbitals are associated with n=4?

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