

## MID TERM EXAMINATION (2024-25)

CHEMISTRY (043)

DATE : 20.9.2024

CLASS XI - D

Time: 3 hours

MM:70

General Instructions:

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 12 multiple-choice questions and 4 assertion reason type questions carrying 1 mark each.
- SECTION B consists of 5 very short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.

## SECTION A

- Which of the following statement is correct in relation of hydrogen atom  
 (a) 3s has lower energy than 3p      (b) 3p has lower energy than 3d  
 (c) 3s and 3p have same energy      (d) 3s, 3p, 3d all have same energy
- The radius of second Bohr's orbit for hydrogen atom is  
 (a) 1.65 Å      (b) 4.76 Å      (c) 0.529 Å      (d) 2.12 Å
- $n = 3, l = 2, m = 2$  is possible for how many orbitals  
 (a) 1      (b) 2      (c) 3      (d) 4
- The number of d-electrons in  $\text{Fe}^{2+}$  ions are  
 (a) 3      (b) 4      (c) 5      (d) 6
- The second Bohr's orbit has energy -328 kJ / mole the energy of 4th Bohr's orbit is  
 (a) -1312 kJ mol<sup>-1</sup>      (b) - 82 kJ mol<sup>-1</sup>      (c) - 145.3 kJ mol<sup>-1</sup>      (d) - 41 kJ mol<sup>-1</sup>
- The general electronic configuration of d-block elements is  
 (a)  $(n - 1)d^{1-10} ns^2$       (b)  $(n - 1)d^{1-10} ns^{0-2}$       (c)  $(n - 1)d^{1-10} ns^{1-2}$       (d)  $(n - 1)d^{1-9} ns^{0-2}$
- The ratio of radii of second and third Bohr orbit of hydrogen atom is :  
 (a) 2 : 3      (b) 3 : 2      (c) 4 : 9      (d) 9 : 4
- The values of four successive ionisation energies are 234, 472, 702, 4798 KJ per mol. The number of valance electrons are:  
 (a) 2      (b) 3      (c) 4      (d) 5
- Which of the following represent a Doberiner's triad?  
 (a) Li, Be, Ne      (b) Li, Na, P      (c) Cl, Br, I      (d) all of these
- Arrange  $\text{Cl}_2, \text{F}_2, \text{Br}_2, \text{I}_2$  in increasing order of reactivity.  
 (a)  $\text{Cl}_2 < \text{F}_2 < \text{Br}_2 < \text{I}_2$       (b)  $\text{F}_2 < \text{Cl}_2 < \text{Br}_2 < \text{I}_2$       (c)  $\text{I}_2 < \text{Br}_2 < \text{Cl}_2 < \text{F}_2$       (d)  $\text{Cl}_2 < \text{Br}_2 < \text{I}_2 < \text{F}_2$
- Which of the following group elements have lowest ionisation enthalpy?  
 (a) 1      (b) 2      (c) 17      (d) 18
- 0.5 mol of  $\text{O}_3$  contains  
 (a)  $6.02 \times 10^{23}$  molecules      (b)  $3.02 \times 10^{23}$  molecules      (c)  $9.02 \times 10^{23}$  molecules      (d) both (a) and (b)

(1)

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason.

- (a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.
- (b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (c) Assertion is false but Reason is true.
- (d) Assertion is true but Reason is false.

13. Assertion : 18 g of water and 18 g of ice will contain same number of molecules.  
Reason : 1 mole of  $H_2O$  (water or ice) = 18 g

14. Assertion : Nitrogen has higher electronegativity than O  
Reason : Oxygen is smaller in size than nitrogen.

15. Assertion: Number of orbitals in 4<sup>th</sup> shell are 16  
Reason: Number of orbitals for any orbital is equal to  $n^2$

16. Assertion: Mole fraction of ethanol in water is 0.040, hence its molarity = 2.31  
Reason : Mole fraction is independent of temperature.

### SECTION - B

17. (a) State modern periodic law.  
(b) What is the cause of periodicity?

18. What are the frequency and wavelength of a photon emitted during a transition from  $n = 5$ , state to the  $n = 2$  state in the hydrogen atom?

19. Calculate: (i) Calculate the volume of 34 gram of  $NH_3$  at STP  
(ii) How many gram atoms are present in 8.0 grammar of sulphur

20. Define ionisation enthalpy. Arrange the elements of 17<sup>th</sup> group in order to increase their electron gain enthalpy

21. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the number of photons emitted per second by the bulb.

### SECTION - C

H  
Li Be  
Na Mg

22. An element X with atomic number 20

i Determine the position of the element X in the periodic table

ii Write the formula of the compound formed when X react with another element Y with atomic number 8

iii What is the nature of compound formed between X & Y

23. A welding fuel gas contains carbon and hydrogen only burning a small sample of it in oxygen gives 3.38 g carbon dioxide, 0.690 g of water and no other products. A volume of 10.0 L of this welding gas is found to weigh 11.6 g. Calculate empirical formula, molar mass of gas and molecular formula.

24. (a) Write two point of differences between Emission and Absorption spectra  
(b) Calculate the number of spectral line produced in 5<sup>th</sup> Bohr's orbit

(2)

OR

- (a) Write two drawbacks of Rutherford's model of atom  
(b) Write the electronic configuration of  $\text{Cr}^{2+}$ , Co

25. (a) Why halogens have high negative electron gain enthalpy?  
(b) An element X has five electrons in its valence shell. Write the formula of its halides  
(c) The element that would tend to gain two electrons. Write its compound with element of thirteen group

26. Calculate the mole fraction of a solution containing 20 grams of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) and 80 grams of water ( $\text{H}_2\text{O}$ ). Also calculate the total mole fraction

27. (a) Cu (I) is diamagnetic but Cu (II) is paramagnetic why?  
(b) If the velocity of the electron in Bohr's first orbit is  $2.19 \times 10^6 \text{ m/s}$ , Calculate the de Broglie wavelength associated with it.

OR

- (a) Why don't we see the nature of a cricket ball?  
(b) Why do many elements have fractional atomic masses?  
(c) Why is energy of electron negative?

28. (a) Why molality preferred over molarity in expressing the concentration of a solution?  
(b) Write two limitations of Dalton's Atomic theory

### SECTION-D

29. Read the given passage and answer the questions that follow:

Mendeleev arranged elements in horizontal rows and vertical columns of a table in order of their increasing atomic weights in such a way that the elements with similar properties occupied the same vertical column or group. Mendeleev published his periodic table. He left the gap in his periodic table and said there are few more elements which will be discovered later on.

Mendeleev predicted the existence of certain elements not known at that time and named 2 of them As eka silicon and eka aluminium

- (i) Name the element which have taken the place of these elements. Ga, Ge  
(ii) Mention the group and the period of these elements in the modern periodic table  
(iii) Classify these elements as metal, nonmetals or metalloids  
(iv) Write the formula of their chlorides?

30. Read the given passage and answer the questions that follow:

Bohr's model explained electrons can revolve only in certain permitted orbits whose angular momentum is integral multiple of  $h/2\pi$  associated with fixed amount of energy. Bohr theory could successfully explain stability of atoms and spectrum of uni electron species. Hydrogen spectrum consist of Lyman, Balmer, Paschen Brackett and Pfund series Bohr's theory Could not explain spectrum of multi electron species, stark effect, Zeeman effect, dual nature of matter de Broglie equation Heisenberg uncertainty principle which leads to orbital concept. Electrons were filled in orbitals according to Aufbau's principle, Hund's rule and Pauli's rule. Each electron is identified by 4 quantum numbers: n, l, m and s, which were derived from Schrodinger's wave equation. Half filled and completely filled orbitals are more stable due to exchange energy and symmetrical distribution of electrons.

- (i) Which orbital is non directional?  
(ii) Why is 4S orbital filled before 3D orbital?  
(iii) Draw the shape of  $2 dx^2-y^2$  orbital  
(iv) Heat treatment of muscular pain involves radiation of wavelength 900 nm. Which of the following Spectral line of hydrogen atom is suitable for this purpose?

(3)

SECTION – E

31. (i) Define and Calculate the concentration of nitric acid in moles per litre in a sample which has Density  $1.40 \text{ g mL}^{-1}$  and the mass percent of nitric acid in it being 69 %
- (ii) What is limiting reagent? In the reaction  $2A + 4B \rightarrow 3C + 4D$ , when 5 moles of A reacts with 6 moles of B then
- (a) Which is the limiting reagent?
- (b) Calculate the amount of C formed

OR

- (i) The molarity of solution of  $\text{H}_2\text{SO}_4$  is 1.35 M. Calculate its molality, The density of solution is  $1.02 \text{ g cm}^{-3}$
- (ii) How much copper can be obtained from 100 g of copper sulphate? ( Atomic mass of Cu = 63.5 amu)

32. (a) Why 2d orbital does not exist?
- (b) Calculate the uncertainty in the position of an electron if uncertainty in its velocity is 0.001%. Mass of electron is  $9.1 \times 10^{-31} \text{ kg}$ , Velocity of electron is 300 m/s.

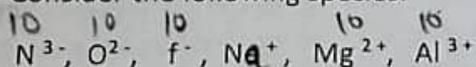
OR

- (a) The kinetic energy of an electron is  $4.55 \times 10^{-25} \text{ J}$ . Calculate its wavelength.
- (b) Calculate the wave number for longest wave length transition in the Balmer series of atomic Hydrogen.

33. Give reasons: (i) Ionization enthalpy of nitrogen is more than that of oxygen
- (ii) Size of gallium is smaller than aluminium.
- (iii) Electron gain enthalpy of chlorine is more than fluorine.
- (iv) The size of an anion is always greater than that of its parent atom.
- (v) Second electron gain enthalpy how oxygen is always positive.

OR

Consider the following species:



- (i) What is common in them
- (ii) Arrange them in the order of increasing ionic radii
- (iii) Write the IUPAC name and symbol for the element with atomic number 120
- (iv) Write 2 point of differences between electron gain enthalpy and electro negativity?

(4)