Kanishka
XI - C
(18)

N.K. BAGRODIA PUBLIC SCHOOL, SEC-4, DWARKA
MID TERM EXAMINATION - SESSION: 2024-25
CLASS: XI
SUB: CHEMISTRY

TIME: 3HRS **MAX. MARKS: 70**

General Instructions:

Read the following instructions carefully.

(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 short answer questions carrying 1 mark each.
(c) SECTION B consists of 5 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 - based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
(h) Use of log tables and calculators is not allowed.

SECTION - A

The following questions are very short answer questions. Each question carries 1 mark. There is no internal choice in this section.

Q1. 500 ml of a 5 M solution is diluted to 1500 ml, find molarity of the solution obtained?   1

Q2 Wavelengths of different radiations are 300 nm, 300pm and 300 A^0. Arrange them in increasing order of their energies.   1

Q3 The enthalpy of the atomisation for the reaction $CH_4(g) \rightarrow C(g) + 4H(g)$ is 1665 kJ mol^{-1}. What is the bond of energy of the C–H bond?   1

Q4 Calculate the number of atoms present in 48 g of oxygen molecule.   1

Q5 Write IUPAC name of an element with atomic number 112.   1

Q6 Identify the extensive properties among the following: 1

enthalpy, molarity specific heat and internal energy

Q7. Select trans uranium elements among the following: 1

Neptunium, Lawrencium, cerium and scandium

Q8 From the following nuclei select the isobars: 1

$^{238}_{92}U$, $^{234}_{90}Th$, $^{234}_{92}U$, $^{236}_{91}Pa$

1

Q9.   Out of BF_3, NF_3 and NH_3, which has zero dipole moment?   1

Q10   Among the following species   1

BF_3, NH_3, PCl_3 and H_2O

Identify the one with 2 lone pairs of electrons.

Q11.   Draw shape of IF_5.   1

Q12   Match the following molecules with their hybridization: 1

COLUMN I   **COLUMN II**

(i) PCl_5 (a) sp^3

(ii) NH_3 (b) sp^2

(iii) $BeCl_2$ (c) sp

(iv) BF_3 (d) sp^3d

Q13   Given below are two statements labelled as Assertion (A) and Reason (R).   1

Assertion (A): Electrons are ejected from a certain metal when either blue or violet light strikes the metal surface. However only violet light cause electron ejection from a second metal.

Reason (R): The electrons in the first metal requires less energy for ejection.

Select the most appropriate answer from the options given below:

(a)   Both A and R are true and R is the correct explanation of A

(b)   Both A and R are true but R is not the correct explanation of A.

(c)   A is true but R is false.

(d)   A is false but R is true.

Q14.   Given below are two statements labelled as Assertion (A) and Reason (R).   1

Assertion (A): The 19th electron in potassium atom enters 3d-orbital and not 4s orbital.

Reason (R): The energies of the orbitals can be compared with the help of (n+l) rule.

Select the most appropriate answer from the options given below:

(a)   Both A and R are true and R is the correct explanation of A

(b)   Both A and R are true but R is not the correct explanation of A.

(c)   A is true but R is false.

(d)   A is false but R is true.

Q15. Given below are two statements labelled as Assertion (A) and Reason (R).   1

Assertion (A): In water the bond angle is 107.5^0.

Reason (R): The lone pair -bond pair repulsion is greater than bond pair - bond pair repulsion

Select the most appropriate answer from the options given below:

(a)   Both A and R are true and R is the correct explanation of A

(b)   Both A and R are true but R is not the correct explanation of A.

(c)   A is true but R is false.

(d)   A is false but R is true.

Q16.   Given below are two statements labelled as Assertion (A) and Reason (R)   1

Assertion (A): The heat absorbed during the isothermal expansion of an ideal gas against vaccum is zero.

Reason (R): The volume occupied by the molecules of an ideal gas is zero.

Select the most appropriate answer from the options given below:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false.

(d) A is false but R is true.

SECTION - B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

Q17.   Using the molecular orbital theory, compare the bond order and magnetic   2
character of O_2^+ and O_2^- species.

Q18   An element with mass number 81 contains 31.7% more neutrons as   2
compared to protons. Assign the atomic symbol.

Q19   Differentiate between   2

(i)   Zeeman effect and Stark effect

(ii)   Orbit and orbital

3

Q20   Among the elements B, Al, C and Si   2

    (i)   Which has the highest first ionization enthalpy?

    (ii)   Which has the most negative electron gain enthalpy?

    (iii) Which has the largest atomic radii?

    (iv)   Which has the most metallic character?

Q21   Show that for an ideal gas $C_p - C_v = R$ 2

<div align="center">OR,</div>

Give the relationship between ΔU and ΔH for gases.

SECTION - C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q22   (i)   In the following balance equation   3

$$4 HCl + MnO_2 \longrightarrow 2H_2O + MnCl_2 + CO_2$$

    If 100 gm of both MnO_2 and HCl is given, which one is limiting agent and which is in excess? What is the amount of $MnCl_2$ formed?

    Given atomic mass of Mn=55

    (ii)   A solution contains 9.75 g of KCl dissolved in 90 g of water, Calculate molality of KCl.

    Given molecular mass of KCl= 97.5

Q23   The combustion of butane (C_4H_{10}) is exothermic by 2878.7 KJ/mol. 3
    Calculate the standard enthalpy of formation of butane, given that the standard enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are $-393.5kJ/mol$ and $-285.8KJ/mol$ respectively

<div align="center">OR,</div>

    For the reaction

    $2NO (g) + O_2(g) \rightarrow 2NO_2(g)$
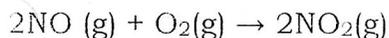
    The enthalpy and entropy changes are $- 113 KJ\ mol^{-1}$ and $- 145Jk^{-1}mol^{-1}$ respectively. Find the temperature at which reaction is spontaneous.

Q24   What is the wavelength and frequency of spectral line emitted when the 3
   electron in a hydrogen atom undergoes transition from n=2 to n=5?

    Given $R_H=1.1 \times 10^5\ cm^{-1}$

Q25. A golf ball has a mass 40 g and speed of 45 m/s. If the speed can be measured within accuracy of 2%, calculate uncertainty in position.   3

Q26 (i) Why Van der Waal's radii are greater than actual atomic radii?   3

(ii) Size of anion is greater than parent atom. Justify.

(iii) Atomic number of an element is 35. To which group and period of periodic table it belongs?

Q27 Calculate the enthalpy change on freezing of 1.0 mole of water at 10.0°C to ice at − 10.0°C.   3

ΔH_{fus} = 6.03 kJ mol^{-1} at 0°C.

$Cp[H_2O(l)]$ = 75.3 J mol^{-1} K^{-1}

$Cp[H_2O(s)]$ = 36.8 J mol^{-1} K^{-1}.

Q28. (a) Vanadium metal is added to impart strength to steel. The density of Vanadium is 5.96g/cm^3. Express in S.I. unit.   3

(b) State law of multiple proportion.

(c) If the speed of light is 3×10^8 m/s, calculate the distance covered by light in 2.00 ns.

SECTION - D

The following questions are case based questions. Each question has an internal choice and carries 4 (1+1+2=4) marks each. Read the passage carefully and answer the questions that follow.

Q29.

Period 3 elements
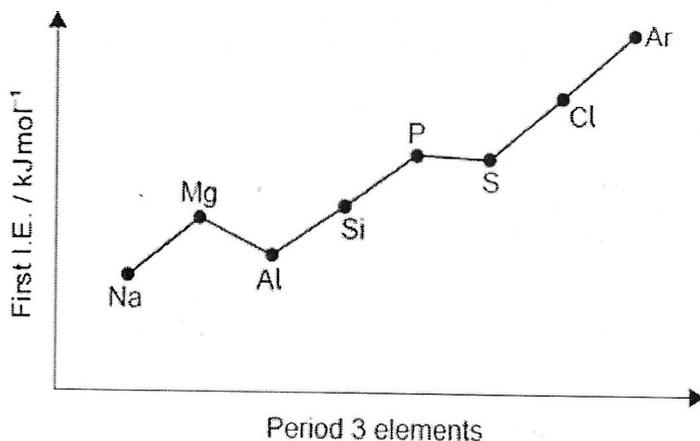
Read the passage given below and answer the questions that follow:

Ionization energy, in simple terms, can be described as a measure of the difficulty in removing an electron from an atom or ion or the tendency of an atom or ion to surrender an electron. The loss of electrons usually happens

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in the ground state of the chemical species. Ionization energy can be further predicted using <u>Bohr's model of an atom</u>. His model predicts the presence of several paths for the electron to go around the nucleus containing protons and neutrons. Each path or orbit is at a fixed distance from the nucleus, and it also represents fixed energy. Electron is a particle and will have the energy of the orbit present. A particle can absorb energy and jump to the next higher orbits of higher energy. If more energy is available and absorbed, the electron will come out of the force of attraction of the nucleus, which means out of the atom.

Answer the following questions:

(a)   First ionisation energy of Magnesium is greater than Aluminium.Justify.

(b)   Will second Ionisation energy of Aluminium be higher or lesser than second Ionisation energy of Mg? Give reason for your answer.

(c)   Ionisation energy decrease down the group but among Group 13 elements Boron, Aluminium, Gallium, Indium, Thallium, the trend is exactly not followed. Identify the exceptional cases and explain.

OR,

(c)   Out of the elements mentioned in the graph, which have positive values of electron gain enthalpies? Identify them giving reason.

Q30   Hydrogen bonding is a special type of dipole-dipole attraction between molecules, not a covalent bond to a hydrogen atom. It results from the attractive force between a hydrogen atom covalently bonded to a very   4 electronegative atom such as a N, O, or F atom and another very electronegative atom. Hydrogen bond strengths range from 4 kJ to 50 kJ per mole of hydrogen bonds. linked to the hydrogen atom.
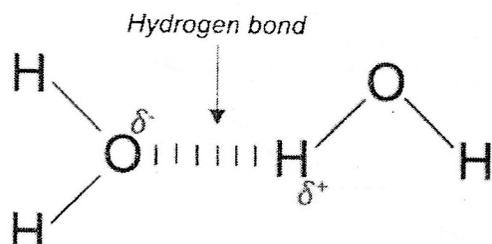
Hydrogen bond

Conditions for H-bonding are

1.   The size of the electronegative atom should be small. The smaller the size, the greater the electrostatic attraction.

2.   The molecule must contain a highly electronegative atom linked to the hydrogen atom. The higher the electronegativity, the more the polarization of the molecule.

Now consider the case of o-nitrophenol and p-nitrophenol and answer the following questions

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(a)   Which of the two has intermolecular and which has intramolecular hydrogen bonding? Show by drawing their structures.

(b)   Which of the two has higher melting point?Justify.

(c)   Which of the two will form hydrogen bonding with water and why?

OR,

(c)   Generally solids sink into water but ice floats. Give a plausible explanation.

SECTION - E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

Q31. (a)   An inorganic salt gave the following percentage composition: 5

Na = 29.1, S = 40.5, O=30.4

Calculate the empirical formula of the compound.

(b)   Calculate the molality of a solution containing 20.7 g of potassium carbonate dissolved in 500 ml of solution.(assume density of solution=1 g/ml).

(c)   How many moles of NaOH are contained in 27ml of 0.15M NaOH?

OR,

(a)   Concentrated H_2SO_4 is 98%.by mass and has density of 1.84g cm^{-3}. What volume of concentrated acid is required to make 5litre of 0.5 M H_2SO_4?

(b)   Calculate the number of atoms in

(i)   52 moles of He

(ii)   52 g of He

Q32. (a)   Draw resonance structures of carbonate ion.   5

(b)   On basis of valence bond theory explain why H_2 molecule exists.

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(c) Explain sp³ hybridisation taking PCl_3 as an example.

OR,

(a) Differentiate between sigma and pi bonds.

(b) Discuss why nitrogen molecule is diamagnetic on basis of molecular orbital diagram.

(c) Explain the formation of sigma and pi bonds in ethene on basis of hybridization.

Q33. Attempt any five of the following: 5

(a) The standard heat of formation of Fe_2O_3 (s) is 824.2kJ mol^{-1} Calculate heat change for the reaction.

$4Fe(s) + 3O_2 (g) \rightarrow 2Fe_2O_3(s)$
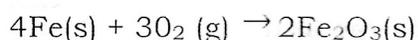
(b) Calculate the change in internal energy of a system if it does 2J of work and absorb 5 J of energy.

(c) Give the expression for isothermal irreversible change,

(d) For a reaction both ΔH and ΔS are positive. Under what conditions will the reaction occur spontaneously?

(e) Internal energy is a state function but work is not. Why?

(f) If the combustion of 1 g of graphite produces 20.7 KJ of heat, what will be molar enthalpy change? Predict the significance of sign also.

(g) Define standard enthalpy of fusion.

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