HALF YEARLY EXAMINATION, 2024-25

CHEMISTRY

Time – 3:00 Hrs. **Class – XI** **M.M. : 80**

Date – 10.09.2024 (Tuesday)

Name of the student _____ **Section** _____

GENERAL INSTRUCTIONS:

- There are 33 questions. All questions are compulsory, however internal choices are there in sections B, D & E.
- SECTION A contains 16 MCQ questions of single correct answer type carrying 1 mark each.
- SECTION B consists of 5 very short answer questions carrying 2 marks each. There is an internal choice in one question.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each. There are internal choices given in subparts of the questions.
- SECTION E consists of 3 long answer questions carrying 5 marks each. Each complete question has an internal choice.

Q.1 Elements A and B form two compounds B_2A_3 and B_2A. 0.05 moles of B_2A_3 weight 9.0 g and 0.10 mole of B_2A weight 10 g. Calculate the atomic weight of A and B :-

(1) 20 and 30 (2) 30 and 40 (3) 40 and 30 (4) 30 and 20

Q.2 For the reaction $A + 2B \rightarrow C$, 5 mol for A and 8 mol of B will produce

(1) 5 mole of C (2) 4 mole of C (3) 8 mole of C (4) 13 mole of C

Q.3 An oxide of metal M has 40% by mass of oxygen. Metal M has atomic mass of 24. The empirical formula of the oxide is –

(1) M_2O (2) M_2O_3 (3) MO (4) M_3O_4

Q.4 Equal masses of H_2,O_2 and methane have been taken in a container of volume V at temeprature 27°C at identical conditions. The ratio of the volumes of gases $H_2 : O_2 : CH_4$ would be :

(1) 8 : 16 : 1 (2) 16 : 8 : 1

(3) 16 : 1 : 2 (4) 8 : 1 : 2

Q.5 The oxidation number of phosphorus in PH_4^+, PO_2^{3-}, PO_4^{3-}, and PO_3^{3-}, are respectively.

(1) –3, +1, +3, +5 (2) –3, +3, +5, +1 (3) +3, –3, +5, +1 (4) –3, +1, +5, +3

Q.6 For Na (Z=11) set of quantum numbers for last electron is -

(1) $n = 3, \ell = 1, m = 1, s = +\frac{1}{2}$ (3) $n = 3, \ell = 0, m = 1, s = +\frac{1}{2}$

(2) $n = 3, \ell = 0, m = 0, s = +\frac{1}{2}$ (4) $n = 3, \ell = 1, m = 1, s = -\frac{1}{2}$

Q.7 Magnetic moment 2.84 B.M. is given by –

(At. no. of Ni-28, Ti=22, Cr=24, Co=27)

(1) Ti^{3+} (2) Cr^{2+} (3) Co^{2+} (4) Ni^{2+}

Q.8 **Assertion :** Black body is an ideal body that emits and absorbs radiations of all frequencies.

Reason : The frequency of radiation emitted by a body goes from a lower frequency to higher frequency with an increase in temperature

(1) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(3) Assertion is correct, reason is incorrect

(4) Assertion is incorrect, reason is correct

Q.9 Which one is the wrong statement ?

(1) The uncertainty principle is $\Delta E \times \Delta t \geq h/4\pi$

(2) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement.

(3) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms

(4) de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$, where m = mass of the particle, v = velocity of the particle

Q.10 From atomic number 58 to 71, elements are placed in which period -

(1) 5^{th} period (2) 6^{th} period (3) 4^{th} period (4) 7^{th} period

Q.11 Which of the following order of radii is correct

(1) Li < Be < Mg (2) $H^+ < Li^+ < H^-$ (3) O < F < Ne (4) $Na^+ > F^- > O^{-2}$

Q.12 Assertion (A): Boron has a smaller first ionization enthalpy than beryllium.

Reason (R): The penetration of a 2s electron to the nucleus is more than the 2p electron, hence, 2p electron is more shielded by the inner core of electrons that the 2s electrons.

(1) Assertion and reason both are correct statements but reason is not correct explanation of assertion.

(2) Assertion is correct statement but reason is wrong statement.

(3) Assertion and reason both are correct statements and reason is correct explanation of assertion.

(4) Assertion and reason both are wrong statement.

Q.13 The correct values of ionisation energies (in kJ mol^{-1}) of Be, Ne, He and N respectively are

(1) 786, 1012, 99, 1256 (2) 1012, 786, 999, 1256

(3) 786, 1012, 1256, 999 (4) 786, 999, 1012, 1256

Q.14 Which of the following having a square planar structure is –

(1) NH^+_4 (2) BF^-_4 (3) XeF_4 (4) CCl_4

Q.15 Assertion (A): Among the two O – H bonds in H_20 molecule, the energy required to break the first O – H bond and other O – H bond is the same.

Reason (R): This is because the electronic environment around oxygen is the same even after breakage of one O – H bond.

(1) A and R both are correct, and R is the correct explanation of A.

(2) A and R both are correct, but R is not the correct explanation of A.

(3) A is true but R is false.

(4) A and R both are false.

Q.16 Which of the following would have a permanent dipole moment?

(1) BF_3 (2) SiF_4 (3) SF_4 (4) XeF_4

SECTION –B

Q.17 Calculate the concentration of nitric acid in moles per litre in a sample which has a density, 1.41 g mL^{-1} and the mass per cent of nitric acid in it being 69%. (Given molar mass of HNO_3 = 63 g/mol)

Q.18 What is the number of photons of light with a wavelength of 4000 pm that provide 1J of energy?

Q.19 An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.

Q.20 Use the periodic table to answer the following questions.

(a) Identify an element with five electrons in the outer sub shell.

(b) Identify an element that would tend to lose two electrons.

Q.21 Which out of NH_3 and NF_3 has higher dipole moment and why ?

OR

Write an application of dipole moment. How dipole moment is calculated? (Write the mathematical expression.)

SECTION –C

Q.22 Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid according to the reaction, **(3)**

$4\ HCl\ (aq) + MnO_2(s) \rightarrow 2H_2O\ (l) + MnCl_2(aq) + Cl_2\ (g)$.

How many grams of HCl react with 5.0 g of manganese dioxide?

(MW of $MnCl_2$ = 125.84, MnO_2 = 86.9)

Q.23 In three moles of ethane (C_2H_6), calculate the following: **(3)**

(i) Number of moles of carbon atoms.

(ii) Number of moles of hydrogen atoms.

(iii) Number of molecules of ethane.

Q.24 Justify that the following reactions are redox reactions: **(3)**

(a) $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$

(b) $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

(c) $4BCl_3(g) + 3LiAlH_4(s) \rightarrow 2B_2H_6(g) + 3LiCl(s) + 3\ AlCl_3\ (s)$

Q.25 The compound AgF_2 is unstable compound. However, if formed, the compound acts as a very strong oxidising agent. Why ? **(3)**

Q.26 a) Define disproportion reaction. Give two examples. **(3)**

b) Difference between oxidation number and oxidation state.

Q.27 The quantum numbers of six electrons are given below. Arrange them in order of increasing energies. If any of these combination(s) has/have the same energy, then identify. **(3)**

1. n = 4, l = 2, m_l = –2 ,m_s = –1/2

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

3. n = 4, l = 1, m_l = 0 ,m_s = +1/2

Q.28 The work function for caesium atom is 1.9 eV. Calculate **(3)**

(a) the threshold wavelength and

(b) the threshold frequency of the radiation. If the caesium element is irradiated with a wavelength 500 nm, calculate the kinetic energy and the velocity of the ejected photoelectron.

SECTION-D

Q.29 S-orbitals are spherical in shape, p-orbitals are dumb bell shaped and d-orbitals are double dumbbell shaped. Transition metals involve d-orbitals which are incompletely filled. They lose electrons from outermost s-orbital first and then from d-orbitals. Bohr's theory could explain spectrum of hydrogen successfully but could not explain Zeeman effect, stark effect, dual nature of electron and shapes of molecules. It could not explain spectrum of multi electron species. **(1+1+2)**

a) The splitting of spectral lines in magnetic field is called which effect?

b) The splitting of spectral lines in electric field is known as which effect?

c) Draw the shape of (i) dz^2 orbital (ii) $d_{x^2-y^2}$

OR

What is the relationship between ν of radiation emitted by single electronic species with Rydberg's constant? Specify n_1 and n_2 for Paschen series.

Q.30 Study the table of electron gain enthalpies of some main group elements and answer the questions that follow based on table and related concepts. **(1+1+2)**

Group 1	$\Delta_{eg}H$	Group 16	$\Delta_{eg}H$	Group 17	$\Delta_{eg}H$	Group 0	$\Delta_{eg}H$
H	–73					He	+48
Li	–60	O	–141	F	–328	Ne	+116
Na	–53	S	–200	Cl	–349	Ar	+96
K	–48	Se	–195	Br	–325	Kr	+96
Rb	–47	Te	–190	I	–295	Xe	+77
Cs	–46	Po	–175	At	–270	Rn	+68

a) Why do group 1 elements have low electron gain enthalpy ?

b) Which Noble gase have highest positive electron gain enthalpy? Why?

c) Arrange S, P, F, Cl in increasing order of electron gain enthalpy. Give reason.

OR

c) Arrange group 16 elements in increasing order of electro negativity. Explain the reason.

SECTION –E

Q31 a) Hydrogen gas is prepared in the laboratory by reacting dilute HCl with granulated zinc. Following reaction takes place: **(3)**

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

Calculate the volume of hydrogen gas liberated at STP when 32.65 g of zinc reacts with HCl. 1 mol of a gas occupies 22.7 L volume of STP; atomic mass of Zn = 65.3 u.

b) Volume of a solution changes with change in temperature, then, will the molality of the solution be affected by temperature? Give reason for your answer. **(2)**

OR

Balance the following equation in acidic medium. **(2)**

a) $MnO_4^-(aq) + SO_2(g) \rightarrow Mn^{+2}(aq) + SO_4^{-2}$

b) Find oxidation numbers of underlined elements. **(3)**

(i) $Ca\underline{O_2}$ (ii) $\underline{Cr}O_5$ (iii) $K\underline{Mn}O_4$

Q32 a) Explain why the electron gain enthalpy of oxygen is less negative than that of sulphur. **(3)**

b) All transition elements are d-block elements, but all d-block elements are not transition elements. Explain. **(2)**

OR

a) p-Block elements form acidic, basic and amphoteric oxides. Explain each property by giving two examples and also write the reactions of these oxides with water. **(3)**

b) Explain the trend of ionisation energy with proper explanation in 2^{nd} period. **(1)**

c) Explain the trend of non metallic property with proper explanation in 17^{th} group. **(1)**

Q33 a) Covalent bonds are directional bonds while ionic bonds are non- directional. Explain. **(1)**

b) Water molecule has bent structure whereas carbon dioxide molecule is linear. Explain. **(1)**

c) Apply VSEPR theory and predict the geometry and shape of the following species- **(3)**

IF_7, XeO_2F_2, CO_3^{2-}

OR

a) Draw the resonance structures of CO_3^{2-}, NO_3^- **(2)**

b) Arrange the following molecules in order of increasing ionic character and explain. **(2)**

LiF, K_2O, N_2, SO_2 and ClF_3

c) How do you express bond length in terms of bond order? **(1)**