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A JESUIT CHRISTIAN MINORITY INSTITUTION

1st TERM EXAMINATION – 2019

Sub: Chemistry
Duration: 3hr 15mins

Class: 11 A1

F.M: 70
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Section -I

(Multiple choice question)

ANSWER KEY

Choose the correct answer: 1×14=14

1. Which of the following has the largest number of atoms?
   a) 0.5g atom of Cu
   b) 0.635g of Cu
   c) 0.25g mol of Cu
   d) 1g of Cu
2. In which mode of expression the concentration of the solution is independent of the temperature?
   a) Molarity
   b) Normality
   c) Formality
   d) Molality
3. The number of atoms in 4.25g of NH_3 is approximately-
   a) 1×10^{23}
   b) 2×10^{23}
   c) 4×10^{23}
   d) 6×10^{23}
4. Correct set of 4 quantum numbers for the outermost electron of Rubidium (Z=37) is-
   a) 5,0,0,1/2
   b) 5,1,0,1/2
   c) 5,1,1,1/2
   d) 6,0,0,1/2
5. If a species has 16 protons, 18 electrons and 16 neutrons. find the species and its charge-
   a) S^{-1}
   b) Si^{+2}
   c) P^{-3}
   d) S^{-2}
6. The number of unpaired electrons in Mn^{+3} is-
   a) 2
   b) 3
   c) 4
   d) 5
7. 0.66kg ball is moving with a speed of $1000ms^{-1}$. The associated wave length will be-
   a) 6.6×10^{-32}
   b) 6.6×10^{-34}
   c) 1.0×10^{-36}
   d) 1.0×10^{-32}
8. What is the general outer shell electronic configuration of the coinage metals?
   a) ns^2,np^5
   b) $(n-1)d^9,ns^1$
   c) $(n-1)d^{10},ns^1$
   d) $(n-1)d^9,ns^2$
9. Identify the correct order of size of the following-
   a) $Ca^{+2}<K^+<Ar<Cl^-<S^{-2}$
   b) $Ar<Ca^{+2}<K^+<Cl^-<S^{-2}$

c) $Ca^{+2}<Ar<K^{+}<Cl^{-}<S^{-2}$
d) $Ca^{+2}<K^{+}<Ar<S^{-2}<Cl$

10. Set containing iso-electronic species is-
a) C_2^{-2},NO^{+},CN^{-},O_2^{+2}
b) CO,NO,O_2,CN^{-}
c) CO_2,NO_2,O_2,N_2O_5
d) CO,CO_2,NO,NO_2

11. Which of the following oxides is amphoteric in character?
a) CaO
b) CO_2
c) SiO_2
d) SnO_2

12. The pyramidal geometry is associated with:
a) CH_4
b) NH_3
c) H_2O
d) CO_2

13. The angle between the covalent bonds is maximum in:
a) CH_4
b) BF_3
c) PF_3
d) NH_3

14. Select the molecule which has only one pi bonds-
a) C_2H_2
b) CH_2=CHCHO
c) $CH_3CH=CH_2$
d) $CH_3C\equiv CCOOH$

Section II

Group-A

(Very short answer type question)

Answer the following questions (Alternatives are to be noted) 1×4=4

1. Name one compound for each of sp^3,sp^2 and sp hybridization.
Ans. sp^3=CH_4 ,sp^2= C_2H_4, sp= C_2H_2

OR

What type of overlap is present in forming σ and π bond?
Ans. For sigma co-axial or head on overlap and for pi side o or lateral overlap.

2. Name two elements one metal and other a non-metal which belong to same group in p-block.
Ans. Metal Al and non metal B

3. Find the equivalent mass of $KMnO_4$ in acid medium.
Ans. 158/5=31.6

OR

Give the general set of quantum numbers which describe an electron in a 4p orbital.
Ans. Principal qn no(n)=4 ,l=1, m=-1,0,+1,s=+1/2 or -1/2

4. What will happen to the wave length associated with a moving particle, if its velocity is doubled?
Ans. The wave length will be reduced to half as λ=h/mv. Both h and m are constant.

Group-B

(Short answer type question-I)

Answer the following questions (Alternatives are to be noted) 2×5=10

1. Is the wave particle duality physically appreciable to a cricket ball in real situations? Explain.

Ans. No, its not appreciable. According to de Broglie's hypothesis $\lambda=h/mv$. As a cricket ball has appreciable mass therefore the wavelength associated with the ball will be very small or very difficult to observe through naked eye.

OR

Give the electronic configuration of Ni and Ni^{+2}. Find the number of unpaired electrons in each case.
Ans. For Ni: $[Ar]4s^2 3d^8$ and for Ni^{+2}: $[Ar]3d^8$

2. Calculate the number of moles of water in 1 L of pure water at 4°C.
Ans. At 4°C the density of pure water=$1 gcm^{-3}$
The mass of $1000cm^3$ of pure water=1000g
1gm mole of pure water=18g
1000gm of pure water=1000/18=**55.55moles**

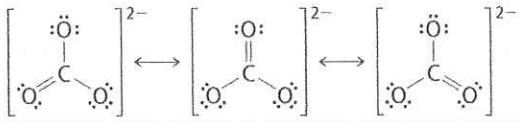
OR

2.49×10^{-18}g of an element A contains 2.0×10^4 atoms. What is the atomic mass of the element A?
Ans. The mass of 2.0×10^4 atoms=2.49×10^{-18}
The mass of 6.023×10^{23}atoms=$(2.49\times10^{-18}\times6.023\times10^{23})/2\times10^4$=**75g**

3. Write two differences between electron affinity and electro-negativity.
Ans.

Electron affinity	Electro-negativity
Amount of energy released or absorbed by a single gaseous atom when an free electron is added to it, from infinite distance, i.e., not under the influence of that atoms nucleus.	The tendency of an element/atom in a compound to attract the covalently bonded electron cloud towards itself.
Applicable to a single free atom	Applicable to an atom in a molecule i.e. in bonded state.

4. Write the resonating structures of carbonate.



OR

Which of the following has larger dipole moment, 1-butyne or 1-butene? Explain.
Ans. 1-butyne as here the carbon is sp hybridised and more electronegative so dipole moment is higher.

5. When α-particles hit a very thin gold foil, very few α-particles are deflected back. What does it prove? explain.
Ans. The whole mass of an atom is concentrated to a very small region and the backward deflection is due to the head on collision of an alpha particle with the massive positively charged nucleus.

Group-C

(Short answer type question –II)

Answer the following questions (Alternatives are to be noted) 3×9=27

1. Fe^{+3} is more stable than Fe^{+2}, Explain Why? Which is more paramagnetic between the given two ions? (2+1)
Ans. As Fe+3 is a d5 system i.e. half filled system so it is more stable ,calculation of exchange energy may also applicable. Fe+3 is more paramagnetic, due to presence of 5 unpaired electrons.

2. How are frequency and wave number related to each other? Give one example from your everyday life where cathode ray tubes are used.
Ans. Frequency=wave velocity× wave number.
The picture tube of the television.

3. Calculate the uncertainty in the velocity of an electron if the uncertainty in its position is 1A°
Ans. Uncertainty in velocity=$(6.625\times10^{-34})/(4\times3.14\times9.1\times10^{-31}\times10^{-10})$=**$5.77\times10^5$m/s**

OR

Calculate the wavelength and energy of radiation emitted for the electronic transition from infinity to 2nd stationary state of H-atom. R =$1.09678\times10^{-7}m^{-1}$, c=$3.0\times10^{8}ms^{-1}$.

Ans. Here n_1=2 and n_2=infinity so λ=**3.647×10^{-7} m** and energy of radiation=5.45×10^{-19}kJ

4. Explain why the 1st ionization energy of C is greater than that of B atom whereas the reverse is true for the 2nd ionization energy.

   Ans. The effective nuclear energy of carbon is more than that of boron and the size of carbon is less than boron.so higher energy required to remove electron from carbon so I.E1 is higher but after losing one electron boron gain stable fulfilled configuration so its 2nd I.E is reverse.

OR

Explain the electron affinity order of group 17 elements.

Ans. Cl>F>Br>I it is due to the small size of F addition of electron is difficult whereas in all other cases presence of vacant d orbital factors in.

5. Though S is just bellow O in group 16 in the periodic table, yet the electron affinity of S is more negative than that of O –Explain.

   Ans. Oxygen has small size so addition of another electron makes a electronic cloud repulsion, but in sulphur presence of vacant d orbital facilitates addition of electron.

6. Percentage composition of an organic compound as determined by analysis was C 40%, H 6.67% and O 53.33%. Its vapour density is found to be 2.813 times that of O. Calculate its molecular formula.

   Ans.

element	%	At.mass	Ratio of the number of gm atoms	Simple atomic ratio
C	40	12	40/12=3.33	1
H	6.67	1	6.67/1=6.67	2
O	53.33	16	53.33/16=3.33	1

Empirical formulaCH_2O

Molecular formula$(CH_2O)n$

Vapour density=16×2.813=45 , mol. Mass=90

N=3

Molecular formula=$C_3H_6O_3$

OR

The ratio of the masses of C, H and N in a compound containing C, H and N is 9:1:3.5. Find its empirical formula. If the molecular mass of the compound is 108, find its molecular formula.

ELEMENT	Ratio of masses	At. mass	Ratio of the no of gm atoms	Simple atomic ratio
C	9	12	9/12=0.75	3
H	1	1	1	4
N	3.5	14	3.5/14=0.25	1

Empirical formula=C_3H_4N

Molecular formula= $C_6H_8N_2$

7. Find the equivalent mass of: SO_4^{-2}, H_2SO_4, Na_2CO_3

   Ans. For sulphate =(32+64)/2=48

   For,sulphuric acid=(2+32+64)/2=49

   For, sodium carbonate=106/2=53 (1×3=3)

8. Find the geometry of the molecule using VSEPR theory: NH_3, SF_4 and PCl_3F_2. (1×3=3)

   Ammonia= Trigonal pyramidal, SF4=TBP/ Distorted TBP / see-saw ,PCl3F2=TBP

OR

B_2 is paramagnetic but C_2 is not-Why?

Ans. Draw the M.O diagram and from the diagram it is evident that two unpaired electrons are there in pi bonding M.O of B_2 , so it is paramagnetic and no unpaired electron is present in C_2 so diamagnetic.

9. A molecule of PCl_5 exists but a molecule of NCl_5 does not exist- explain.

   Ans. Due to presence of vacant 'd' orbital of P.

OR

Out of Me_3NO (μ=5.76D) and Et_3PO (μ=4.69D), Me_3NO has larger dipole moment Why?

Ans. Since all bond moments in 1st compound are oriented in the same direction ,the overall dipole moment is higher than the 2nd compound where the bond moments are oriented in opposite directions.

GROUP-D

(Long answer type questions)

Answer the following questions: (Alternatives are to be noted) 5×3=15

1. Consider the following species:N^{-3},O^{-2},F^-,Na^+,Mg^{+2},Al^{+3} (2+3)
   a) What is common in them? ans. All of them have 10 electrons each so iso electronic in nature.
   b) Arrange them in order of increasing radii. Ans. $Al^{+3} < Mg^{+2} < Na^+ < F^- < O^{-2} < N^{-3}$

   Mg has relatively high ionization energy than that of Al although the atomic number of Al is more than that of Mg- Explain Why?

   Ans. Mg has a filled 3s orbital, thus stable. Al has partially filled 3p orbital. So, easily donates an electron to achieve filled $3s^2$ configuration.

OR

How do the following properties of the elements change as we move from left to right across a period and from top to bottom in a group: (1×5=5)

   a) Atomic volume. L →R: decreases then increases, U→D: increases
   b) Valency L→R: Increases, U→D: Remains same
   c) Electro-negativity L→R: Increases, U→D: Decreases
   d) Ionization energy L→R: Increases, U→D: Decreases
   e) Oxidising and reducing property, Ox L→R increases, U→D: Decreases. Reduction is the opposite

2. What are the limitations of Bohr's atomic model? Derive de Broglie's equation.

   Ans. Only applicable for 1 electronic system and does not explain fine structure.

   $E=mc^2$ and $E=hc/\lambda$ or, $mc^2= hc/\lambda$ or, $mc= h/\lambda$ or $\lambda=h/mc$. Now for all non-relativistic cases, c can be replaced by v. Therefore we have, $\lambda=h/mv$.

OR

Write down the ground state electronic configuration of: **Cr^{+3}: [Ar]$3d^3$, Cu: [Ar]$4s^1 3d^{10}$, Ni^{-3}: [Ar]$4s^2 3d^{10} 4p^1$, V^{+3}: [Ar]$4s^2$, Mn^{+3}: [Ar]$4s^2 3d^2$** (1×5=5)

3. Find the number of electrons present in 1.6 g of CH_4. Derive the relationship between vapour density and molecular mass. (2+3)

   Ans. One mole of C has 6×6.023×10^23 number of electrons.

   Four moles of H has 4×6.023×10^23 number of electrons.

   Therefore one mole of CH_4 has 10×10^23 number of electrons.

   1.6 g CH_4 is 0.1 g.mole of methane. Therefore 1.6g CH_4 contains 6.023×10^23 number of electrons.

   M=2d