

## CBO Chemistry Class XI 2022-23

### Basic Concepts of Chemistry

- In an organic compound of molar mass  $108 \text{ g mol}^{-1}$  C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular formula can be:  
(A)  $\text{C}_6\text{H}_8\text{N}_2$                       (B)  $\text{C}_7\text{H}_{10}\text{N}$                       (C)  $\text{C}_5\text{H}_6\text{N}_3$                       (D)  $\text{C}_4\text{H}_{18}\text{N}_3$
- How many moles of magnesium phosphate,  $\text{Mg}_3(\text{PO}_4)_2$  will contain 0.25 mole of oxygen atoms?  
(A)  $3.125 \times 10^{-2}$                       (B)  $1.25 \times 10^{-2}$                       (C)  $2.5 \times 10^{-2}$                       (D) 0.02
- A 5.2 molal aqueous solution of methyl alcohol,  $\text{CH}_3\text{OH}$ , is supplied. What is the mole fraction of methyl alcohol in the solution?  
(A) 0.086                      (B) 0.050                      (C) 0.100                      (D) 0.190
- 214.2 g of sugar syrup contains 34.2 g of sugar. The molality of the solution will be  
(A) 0.555 m                      (B) 0.0099 m                      (C) 1.2 m                      (D) 1.055 m
- A compound contains 50% of X (at mass 10) and 50% of Y (at mass 20). The formula of the compound is:  
(A) XY                      (B)  $\text{X}_2\text{Y}$                       (C)  $\text{X}_3\text{Y}_4$                       (D)  $(\text{X}_3)_3\text{Y}_3$

In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below.

- Both A and R are true and R is the correct explanation of A.
  - A is true but R is false.
  - A is false but R is true.
  - Both A and R are false.
- Statement-I : 16 g each  $\text{O}_2$  and  $\text{O}_3$  contains  $N_A/2$  and  $N_A/3$  atoms respectively.  
Statement-II : 16 g  $\text{O}_2$  and  $\text{O}_3$  contains same no. of atoms.
  - Statement-I : 44 g of  $\text{CO}_2$ , 28 g of CO have same volume at STP.  
Statement-II : Both  $\text{CO}_2$  and CO are formed by C and oxygen.
  - Statement-I : Law of conservation of mass hold good for nuclear reaction.  
Statement-II : Law states that mass can be neither created nor destroyed in a chemical reaction.
  - Statement-I : A reactant that is entirely consumed when a reaction goes to completion is known as limiting reactant.  
Statement-II : The amount of reactant limits the amount of product formed
  - Statement-I : The molality and molarity of dilute aqueous solutions differ very little.  
Statement-II : The density of water is  $1.0 \text{ g cm}^{-3}$  at room temperature.

#### Comprehension:

Potash is any potassium mineral that is used for its potassium content. Most of the potash produced in the United States goes into fertilizer. The major sources of potash are potassium chloride (KCl) and potassium sulphate ( $\text{K}_2\text{SO}_4$ ). Potash production is often reported as the potassium oxide ( $\text{K}_2\text{O}$ ) equivalent or the amount of  $\text{K}_2\text{O}$  that could be made from a given mineral. KCl costs Rs. 50 per kg.

- What is the cost of K per mole of the KCl sample?  
(A) Rs. 13.42  $\text{mol}^{-1}$                       (B) Rs. 3.73  $\text{mol}^{-1}$                       (C) Rs. 1.00  $\text{mol}^{-1}$                       (D) Rs. 2.00  $\text{mol}^{-1}$
- What mass (in kg) of  $\text{K}_2\text{O}$  contains the same number of moles of K atoms as 1.00 kg KCl?  
(A) 0.158 kg                      (B) 0.315 kg                      (C) 1.262 kg                      (D) 0.631 kg

Calcium lactate is used in the food and beverage industries. It has also been used medicinally for treatment of various allergies, for treatment of muscular leg cramps, and as an antidote for a variety of poisons, including lead, arsenicals and carbon tetrachloride. A 0.8274 g sample of anhydrous calcium lactate is found by analysis to contain 0.2732 g of C, 0.0382 g H, 0.1520 g Ca and 0.3640 g O. Each mole of calcium lactate is found to contain one mole of calcium ions. Calcium lactate can be crystallised from water as pentahydrate salt

- Simplest formula of the calcium lactate is :  
(A)  $\text{CaO}_6\text{C}_6\text{H}_{10}$                       (B)  $\text{CaO}_3\text{C}_3\text{H}_5$                       (C)  $\text{CaO}_2\text{C}_3\text{H}_5$                       (D)  $\text{CaO}_2\text{C}_3\text{H}_5$
- Formula weight of calcium lactate is :  
(A) 129  $\text{g mol}^{-1}$                       (B) 111  $\text{g mol}^{-1}$                       (C) 218  $\text{g mol}^{-1}$                       (D) 113  $\text{g mol}^{-1}$
- How many grams of calcium lactate pentahydrate would be recovered from 1 g of anhydrous salt  
(A) 1.41 g                      (B) 1.00 g                      (C) 1.27 g                      (D) 1.51 g

## Structure of Atom

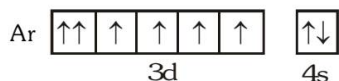
16. Tritium atom contains  
(A) 1e, 1p, 1n (B) 1e, 1p, 2n (C) 2p, 2e, 1n (D) 1e, 1p, 3n
17. In Manganese atom, in ground state, the total number of orbitals populated with one or more electrons are  
(A) 10 (B) 12 (C) 14 (D) 15
18. The ion that is iso electronic with CO  
(A)  $\text{CN}^-$  (B)  $\text{O}_2^-$  (C)  $\text{O}_2^+$  (D)  $\text{N}_2^+$
19. Which atomic particle would be undeflected in an electric field?  
(A) Neutron (B) Proton (C) Alpha particle (D) Beta particle
20. The correct order of energies of the given rays is  
I. U.V II. IR III. Micro IV. X-ray  
(A)  $\text{IV} > \text{I} > \text{II} > \text{III}$  (B)  $\text{IV} > \text{I} > \text{III} > \text{II}$  (C)  $\text{I} > \text{IV} > \text{II} > \text{III}$  (D)  $\text{III} > \text{IV} > \text{I} > \text{II}$
- In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below.  
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(B) A is true but R is false.  
(C) A is false but R is true.  
(D) Both A and R are false.

21. Statement-I: Nodal plane of  $p_x$  atomic orbital is yz plane.  
Statement-II: In  $p_x$  atomic orbital electron density is zero in the yz plane.
22. Statement-I: No two electrons in an atom can have the same values of four quantum numbers.  
Statement-II: No two electrons in an atom can be simultaneously in the same shell, same subshell, same orbitals and have same spin.
23. Statement-I: p-orbital has dumb-bell shape.  
Statement-II: Electrons present in p-orbital can have one of three values for 'm', i.e. 0, +1, -1
24. Statement-I: The configuration of B atom cannot be  $1s^2 2s^3$ .  
Statement-II: Hund's rule demands that the configuration should display maximum multiplicity.
25. Statement-I: Each electron in an atom has two spin quantum numbers.  
Statement-II: Spin quantum numbers are obtained by solving Schrodinger wave equation.

Read the following rules and answer the questions at the end of it.

- \* Electrons in various suborbitals of an orbit are filled in increasing order to their energies.
- \* Pairing of electrons in various orbitals of a suborbital takes place only after each orbital is half-filled.
- \* No two electrons in an atom can have the same set of quantum number.

26. Cr ( $Z = 24$ ),  $\text{Mn}^+$  ( $Z = 25$ ),  $\text{Fe}^{2+}$  ( $Z = 26$ ) and  $\text{Co}^{3+}$  ( $Z = 27$ ) are isoelectronic each having 24 electrons. Thus,  
(A) all have configurations as  $[\text{Ar}] 4s^1 3d^5$   
(B) Cr and  $\text{Mn}^+$  have configurations as  $[\text{Ar}] 4s^1 3d^5$  while  $\text{Fe}^{2+}$  and  $\text{Co}^{3+}$  have configurations as  $[\text{Ar}]^3 d^5$ .  
(C) all have configurations as  $[\text{Ar}] 3d^6$   
(D) all have configurations as  $[\text{Ar}] 4s^2 3d^6$
27. A compound of vanadium has a magnetic moment of 1.73 BM. Electronic configuration of the vanadium ion in the compound is:  
(A)  $[\text{Ar}] 4s^0 3d^1$  (B)  $[\text{Ar}] 4s^2 3d^3$  (C)  $[\text{Ar}] 4s^1 3d^0$  (D)  $[\text{Ar}] 4s^0 3d^5$
28. The sub-shell that arises after f sub-shell is called g sub-shell.  
(A) it contains 18 electrons and 9 orbitals  
(B) it corresponds to  $l = 4$  and first occurs in 5<sup>th</sup> energy level  
(C) a g-orbital can have maximum of two electrons  
(D) all the above statements are true.
29. While writing the following electronic configuration of Fe some rules have been violated :  
I : Aufbau rule,  
II : Hund's rule  
III : Pauli's exclusion principle



3d

4s

- (A) I, II                      (B) II, III                      (C) I, III                      (D) I, II, III

### Periodic Classification and Periodicity in Properties

30. According to the Periodic law of elements, the variation in properties of elements is related to their:  
 (A) Nuclear masses                      (B) Atomic numbers  
 (C) Nuclear neutron-proton number ratio                      (D) Atomic masses
31. The atomic numbers of vanadium, (V), chromium (Cr), manganese (Mn) and iron (Fe) are respectively 23, 24, 25 and 26. Which one of these may be expected to have the highest second ionization enthalpy?  
 (A) Cr                      (B) Mn                      (C) Fe                      (D) V
32. Which of the following ions has the highest value of ionic radius?  
 (A)  $O^{2-}$                       (B)  $B^{3+}$                       (C)  $Li^+$                       (D)  $F^-$
33. Which of the following oxides is amphoteric in character?  
 (A)  $SnO_2$                       (B)  $SiO_2$                       (C)  $CO_2$                       (D)  $CaO$
34. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is:  
 (A)  $I > Br > Cl > F$                       (B)  $F > Cl > Br > I$                       (C)  $Cl > F > Br > I$                       (D)  $Br > Cl > I > F$
35. The number of paired electrons in oxygen atom is:  
 (A) 6                      (B) 16                      (C) 8                      (D) 32

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 (C) A is false but R is true.  
 (D) Both A and R are false.

36. Statement -1 : Two successive ionisation energies of Argon are 56.8 eV and 36.8 eV respectively.  
 Statement -2 :  $Z_{eff}$  of Ar ( $3s^23p^6$ ) is greater than  $Ar^+$  ( $3s^23p^5$ ).
37. Statement -1 : Electron affinity of fluorine is greater than chlorine.  
 Statement -2 : Ionisation enthalpy of fluorine is less than chlorine
38. Statement -1 : Atomic radius of inert gases is largest in the period  
 Statement -2 : Effective nuclear charge of inert gases is minimum
39. Statement -1 : 2nd IP of alkali metals is maximum in the period.  
 Statement -2 : Alkali metals has smallest atomic size in the period.
40. Statement -1 : First ionization energy of nitrogen is lower than oxygen.  
 Statement -2 : Across the period effective nuclear charge decreases.

### COMPREHENSION BASED QUESTIONS

Ionization energies of five elements in kcal/mol are given below:

Atom	I	II	III
P	300	549	920
Q	99	734	1100
R	118	1091	1652
S	176	347	1848
T	497	947	1500

41. Which element is a noble gas?  
 (A) P                      (B) T                      (C) R                      (D) S

42. Which element form stable unipositive ion:  
(A) P                    (B) Q                    (C) R                    (D) S
43. The element having most stable oxidation state +2 is :  
(A) Q                    (B) R                    (C) S                    (D) T
44. Which is a non-metal (excluding noble gas):  
(A) P                    (B) Q                    (C) R                    (D) S
45. Which of the following pair represents elements of same group:  
(A) Q, R                (B) P, Q                (C) P, S                (D) Q, S

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