BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS

SENIOR SECONDARY| CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

MID-TERM EXAMINATION 2023-24

CHEMISTRY (43) Answer Key

Class : XI **Duration: 3 Hrs**

Date : 16/9/24 **Max. Marks: 70**

1. (d) 6×10^{22}

2. (a) neutron and proton

3. (a) 16 g of O_2 and 14 g of N_2

4. (b) 4

5. (d) 3f

6. (b) 0

7. (a) Size, shape and orientation

8. (b) $(n-2)f^{1-14}$ $(n-1)d^{0-1}$ ns^2

9. (a) Ubn and unbinilium

10. (b)lanthanoids

11. (d) AB

12. (c) 120°

13. a

14. b

15. c

16. a

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.

17. Mass % = Mass of A /total Mass x100 1

Mass % = 2/20 x100 1

18 . (i) 16 g (ii) 98 1+ 1

19. nu = c/ lamda $3 \times 10^8 / 3.6 \times 10^{10}$ = $1/1.2 \times 10^{-2}$ Hz 1+ 1

OR

Lamda = h/mv = $6.67 \times 10^{-34}/0.01 \times 10$

20. cation has more proton 1 and more force of attraction. 1 \

21. (a) Li. (b) :Cl:: .

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.

22. Explain the following terms with suitable examples: 3

(i) number of moles per litre is called molarity.

(ii) number of moles of solute per kg of solvent

(iii) $N_A/N_A + N_B$

23. Combustion of methane : $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ 1

No. of moles of methane in 16g of it =given wt.mol. wt.=1616=1 mole

From the reaction, Amount of water produced by the combustion of 1 mole of methane = 2 moles

weight of 1 mole of water =18g ⇒ weight of 2 moles of water =2×18=36g 1

Since, the given weight of methane is 16 g, hence the water produced by the combustion of 16 g of methane is 36 g. 1

24. (a) Be 1 (b) Cl 1 (c) Sc 1

25. ν^0 7.0 $\times 10^{14}\ s^{-1}$ $\nu = 1.0 \times 10^{15}\ s^{-1}$ h= 6.63×10^{-34} js 3

$h\nu = h\nu^0 + \frac{1}{2} mv^2$

26. six points 3

OR

Any six points

27. sharing tendency of electron

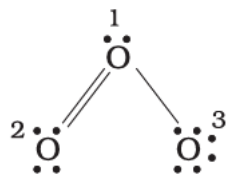
Single bond one- one electron sharing H_2

Double bond two- two electron sharing O_2

Triple bond three- three electron sharing N_2 3

28. Let us consider the ozone molecule (O_3). The Lewis structure of O_3 may be drawn as:

The atoms have been numbered as 1, 2 and 3.

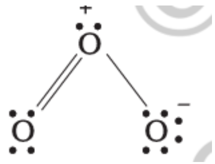


The formal charge on: •

The central O atom marked 1 = 6 – 2 – 1 2 (6) = +1 •

The end O atom marked 2 = 6 – 4 – 1 2 (4) = 0 •

The end O atom marked 3 = 6 – 6 – 1 2 (2) = –1

 Hence, we represent O3 along with the formal charges as follows:

SECTION D

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

29. The set of numbers used to describe the position and energy of the electron in an atom are called quantum numbers. There are four quantum numbers, namely, principal, azimuthal, magnetic and spin quantum numbers. The values of the conserved quantities of a quantum system are given by quantum numbers. Electronic quantum numbers (the quantum numbers describing electrons) can be defined as a group of numerical values which provide solutions that are acceptable by the Schrodinger wave equation for hydrogen atoms.

(a) size 1

(b) orientation 1

(c) n=2 l=1 and n=3 l=2 1+1

OR

(c) 2p 5f

30.

(a) gaining tendency of electron by the atom 1

(b) loosing tendency of electron by the atom 1

(c) between sharing of atom and individual atom .2

OR

(c) compact size and repulsion of electron 2

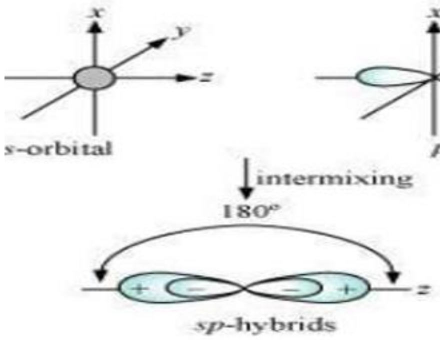
SECTION E

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

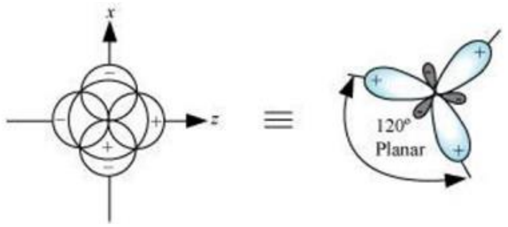
31. is defined as an intermixing of a set of atomic orbitals of slightly different energies, thereby forming a new set of orbitals having equivalent energies and shapes. For example, one 2s-orbital hybridizes with two 2p-orbitals of carbon to form three new sp2 hybrid orbitals. These hybrid orbitals have minimum repulsion between their electron pairs and thus, are more stable. Hybridization helps indicate the geometry of the molecule. Shape of sp hybrid orbitals: sp hybrid orbitals have a linear shape. They are formed by the intermixing of s and p orbitals as:

Shape of sp2 hybrid orbitals: sp2 hybrid orbitals are formed as a result of the intermixing of one s-orbital and two 2p-orbitals. The hybrid orbitals are oriented in a trigonal planar arrangement as: Shape of sp2 hybrid orbitals: sp2 hybrid orbitals are formed as a result of the intermixing of one s-orbital and two 2p-orbitals.

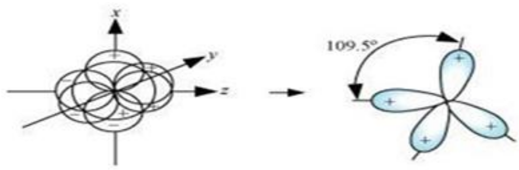
The hybrid orbitals are oriented in a trigonal planar arrangement as:



Shape of sp2 hybrid orbitals: sp2 hybrid orbitals are formed as a result of the intermixing of one s-orbital and two 2p-orbitals. The hybrid orbitals are oriented in a trigonal planar arrangement as:



Shape of sp3 hybrid orbitals: Four sp3 hybrid orbitals are formed by intermixing one s-orbital with three p-orbitals. The four sp3 hybrid orbitals are arranged in the form of a tetrahedron as:



OR

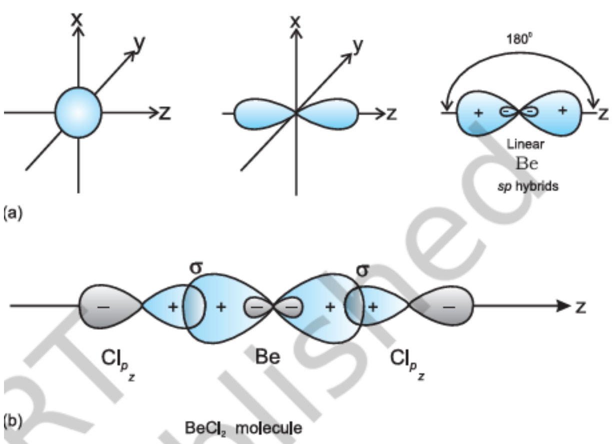
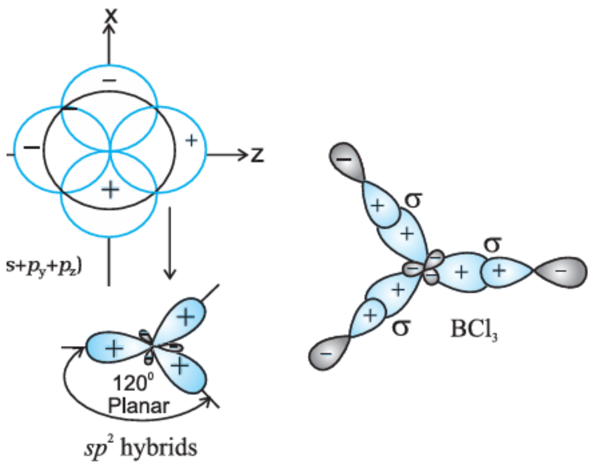


Fig.4.10 *(a) Formation of sp hybrids from s and p orbitals; (b) Formation of the linear $BeCl_2$ molecule*



g.4.11 *Formation of sp² hybrids and the BCl_3 molecule*

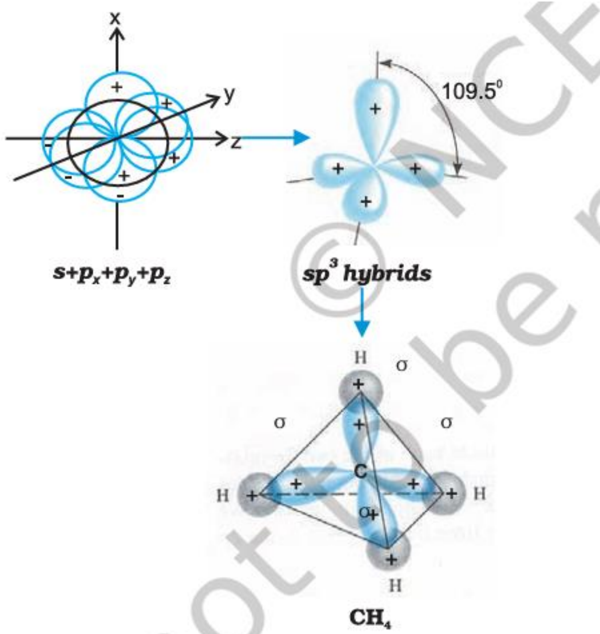


Fig.4.12 *Formation of sp^3 hybrids by the combination of s, p_x, p_y and p_z atomic orbitals of carbon and the formation of CH_4 molecule*

32. (i) ununnilium 1 5

(ii) (a) Li Na K (b) Br Cl ,F

(iii) group 14 and period 3

(iv) the group which represent periodic table s and p block.

OR

(a) Use the periodic table to answer the following questions.

(i) 6 carbon

(ii) Na or k

(iii) F or Cl

(b)

(i) Cl

(ii) Sc

33. Packets of number

and n l m and s explanation 5

Or

(a) 3d10 and 4s1

(b) 1s2 2s2 2p6

(c) 9

(d) no two electrons in an atom can have the same set of four quantum numbers. Pauli exclusion principle can also be stated as : “only two electrons may exist in the same orbital and these electrons must have opposite spin.”

(e) pairing of electrons in the orbitals belonging to the same subshell (p, d or f) does not take place until each orbital belonging to that subshell has got one electron each i.e., it is singly occupied.

Calculate the amount of water (g) produced by the combustion of 16 g of methane.

Solution The balanced equation for the combustion of methane is : CH_4 (g) + $2O_2$ (g) → CO_2 (g) + $2H_2O$ (g) (i) 16 g of CH_4 corresponds to one mole. (ii) From the above equation, 1 mol of CH_4 (g) gives 2 mol of

H_2O (g). 2 mol of water (H_2O) = 2×(2+16) = 2×18 = 36 g 1 mol H_2O = 18 g H_2O ⇒ 18gHO Hence, 2 mol H_2O× 18gHO = 2×18 g H_2O = 36 g H_2

The threshold frequency ν_0 for a metal is 7.0×10^{14} s^{-1}. Calculate the kinetic energy of an electron emitted when radiation of frequency $\nu = 1.0 \times 10^{15}$ s^{-1} hits the metal.

solution According to Einstein's equation Kinetic energy = ½ $m_e v^2 = h(\nu - \nu_0)$ = $(6.626 \times 10^{-34}$ J s$)$ $(1.0 \times 10^{15}$ $s^{-1} - 7.0 \times 10^{14}$ $s^{-1})$ = $(6.626 \times 10^{-34}$ J s$)$ $(10.0 \times 10^{14}$ $s^{-1} - 7.0 \times 10^{14}$ $s^{-1})$ = $(6.626 \times 10^{-34}$ J s$) \times (3.0 \times 10^{14}$ $s^{-1})$ = 1.988×10^{-19} J

The set of numbers used to describe the position and energy of the electron in an atom are called quantum numbers. There are four quantum numbers, namely, principal, azimuthal, magnetic and spin quantum numbers. The values of the conserved quantities of a quantum system are given by quantum numbers. Electronic quantum numbers (the quantum numbers describing electrons) can be defined as a group of numerical values which provide solutions that are acceptable by the Schrodinger wave equation for hydrogen atoms.

1. Pauli exclusion principle helps to calculate the maximum number of electrons that can be accommodated in any (a) orbital (c) shell (b) subsell (d) All of these Ans- (a)

2. The magnetic quantum number of an atom is related to the

(a) size of the orbital (c) orbital angular momentum

(b) spin angular momentum (d) orientation of the orbital in space

Ans-(d)

3. The principal quantum number of an atom is related to the

(a) size of the orbital (c) orbital angular momentum

(b) spin angular momentum (d) orientation of the orbital in Spence

Ans- (a)

4. The maximum number of electrons on a subshell is equal to _______ where l = _______

Ans- 4l + 2; Azimuthal quantum numbers

Q.12:- What is meant by hybridisation of atomic orbitals? Describe the shapes of sp, sp^2, sp^3 hybrid orbitals.
Ans- Hybridization