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Appendix 1a

General Intelligence Test for Higher Secondary Students (GITHSS)

1. Sand is to water, as ................. is to Ocean.
a) Fish  b) Desert  c) Ship  d) Birds

2. Which one does not belong to the same class in the following?
   a) Lizard  b) frog  c) Crab  d) Fish

3. Spot the stranger
   a) USA  b) U.S.S.R  c) India  d) Gujarat

4. If 8 x 6 = 43, 6 x 14 = 32, 2 x 12 then what will be 4 x 8 =?
   a) 32  b) 16  c) 24  d) 48

5. Iron is to wood as ................. is to carpenter?
   a) Painter  b) Blacksmith
   c) Doctor  d) Porter

6. If gas is to hydrogen then liquid is to.................?
   a) Mercury  b) Nitrogen
   c) Ammonia  d) Sulphur

7. Ram finishes a work in 5 days and Shyam finishes the same in 20 days. If both of them work together, then in how many days will they finish it?
   a) 8 days  b) 5 days
   c) 6 days  d) 4 days

8. If Mohan earns 20% profit than Sohan in a business, how much loss does Sohan suffer on account of Mohan?
   a) 20% loss  b) neither profit nor loss
   c) 10% loss  d) 40% loss

9. Students go to College to...............?
   a) Prepare for Life  b) Provide work for professors
c) Play games  
d) Keep themselves out of mischief

10. Allahabad is famous because..................
   
a) It is a centre of Education       b) It has a Railway Junction
   c) It is a holy city               d) It has High Court

11. Ram is elder than Shyam, and Shyam is elder than Hari, then Ram is ................ from Hari?
   
a) Elder                           b) Neither elder nor younger
   c) Younger                        d) Cannot say

12. Kamala runs fast than Vimla but remains back from Chapla, Who is fastest runner?
   
a) Kamala                          b) Chapla
   c) Vimla                          d) Cannot say

13. Should Co-education be banned in India? Yes, because it spoils the boys and girls and takes them away from our Culture. No, because it helps boys and girls to understand each other.
   
a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
   d) Neither ‘Yes’ nor ‘No’ is correct

14. Should the present examination system be discontinued? ‘Yes’ because it is not a proper measure of assessing a candidate’s ability. ‘No’ because there is no alternative system to replace it.
   
a) Only argument ‘Yes; is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
d) Neither ‘Yes’ nor ‘No’ is correct

15. Find the odd man out
   a) Jupiter       b) Appolo       c) Mars        d) Neptune

16. Find the pair which is different from the others..............
   a) Garden and Canteen     b) Baby and Doll
   c) Bulb and Light         d) Pen and Paper

17. Insert the missing number ............ 4 9 17 35?
   a) 149       b) 69       c) 79       d) 49

18. One number is wrong in the following what should that number be?
   20, 21, 23, 26, 30, 35, 40, 48
   a) 22    b) 41    c) 25    d) 34

19. If the effect of Race is Fatigue then the effect of Fast will be...............?
   a) Hunger   b) Fever   c) Sleep   d) Laziness

20. If kill is to Bomb then Football is to?
   a) Smoke   b) Air   c) Team   d) Kick

21. Insert the missing number........... 215: 260: : 713 : ?
   a) 215      b) 758      c) 785      d) 875

22. If statue is to Shape then Song is to?
   a) Music       b) Entertainment
   c) Tune       d) Instrument

23. A student needed 25% marks to pass the examination but he obtained 35% and failed by 15 marks. What marks did he obtain in the Examination?
24. Ram has a bundle of 70 rupee notes. If the number of first is 1418, then what will be number of the last note?

   a) 1486       b) 1487       c) 1488       d) 1489

25. The person is the best friend who..............

   a) lends you money
   b) is true to you at the time of need
   c) tells you that you are a good fellow
   d) cheers you up

26. Insert the missing number - 7, 9, 40, 74, 1526, ------

   a) 5436       b) 5468       c) 6486       d) 3456

27. 1/4 part of an electric pole was coloured red, 1/5 part black, 1/3 part white, leaving 13 metre length of the pole, what is the total length of the pole?

   a) 73 metre    b) 60 metre    c) 52 metre    d) 37 metres

28. Letters are sent by Air Mail because

   a) Airmail envelops are beautiful
   b) Letters provide Cargo for aeroplanes
   c) it is quicker than other mailing procedures
   d) it is safer way

29. Ramu will be five times as old in 48 years as he is now. What is his present age?

   a) 14 years    b) 12 years    c) 8 years    d) 10 years
30. Should legal aid be given to the poor in India? Yes, because they too have the right to fulfil the primary needs and lead a normal life. No, because the country’s wealth will only go in waste
   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
   d) Neither ‘Yes’ nor ‘No’ are correct

31. If a man walks 11 miles toward North and then turning to South, walks 6 miles. How far is he from his starting point?
   a) 17 miles               b) 11 miles           c) 5 miles                d) 6 miles

32. Which one of these four is different from the rest?
   a) Tea                      b) Coffee              c) Lemonade           d) Soda water

33. Ramlal gets 20% profit by selling five packs of tea leaves for Rs, 150/- If he wants 24% profit how much should be changed for each pack?
   a) Rs. 30/-               b) Rs. 31/-               c) Rs. 32/-             d) Rs. 33/-

34. Was it wise to hold the IX Asian Games in India? Yes because it enhanced the prestige of India in World Community. ‘No’ because India had to spend a huge amount of money on these games.
   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
   d) Neither ‘Yes’ nor ‘No’ are correct

35. Find the odd man out -
   a) Bengal               b) Punjab            c) Kerala           d) Agra
36. If kilogram is to Gram, then Litre is to .......?
   a) Metre    b) Quart   c) Millimetre   d) Kilogram

37. Find the odd man out
   a) English  b) Chinese  c) Germany  d) Indian

38. Insert the missing number in 10, 9, 12, 8, 14, 7 .........
   a) 16        b) 15         c) 18        d) 20

39. Insert the mathematical signs between the figures in the following
    795  5  5  = 154
   a) + & -    b) x & -   c) ÷ & -    d) - & -

40. Which one is of different class?
   a) Sugar  b) Salt  c) Oil  d) Glucose

41. Raj walks 50 steps in 5 minutes and Manoj walks 60 steps in 5 minutes. In how much time
    would they together walk 5500 steps?
   a) 40 minutes  b) 110 minutes  c) 50 minutes  d) 90 minutes

42. A boy is chosen the Captain of a team, because -
   a) He is extremely popular
   b) He is the senior most
   c) He get the best out of his team - mates
   d) He got special training from qualified Coach

43. If the sides of a triangle are 42”, 12” and 28” respectively then what will be the area of this
    triangle?
   a) 84        b) 14112       c) 1764       d) Nothing
44. Agra is famous because -
   a) It is a historical Place
   b) It is a Industrial Town
   c) Mughal Emperors ruled here
   d) Taj Mahal is here

45. One can overcome difficulties by -
   a) running away from them
   b) taking help of others
   c) boldly facing them
   d) blaming others for causing them

46. Should Cow-slaughter be banned in India? ‘Yes’ because such a step would enable us to respect the religious feelings of the Hindus and protect the cows. ‘No’ because dry and old cows will only be a burden for the society and the Nation.
   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
   d) Neither ‘Yes’ nor ‘No’ are correct

47. A man is going towards East. He turns towards his right and walks, then again he turns towards his right and walks and turns his right again and continues walking again turning to his right. In which direction is he walking?
   a) North                    b) South                c) East                   d) West

48. Was it wise to hold the IX Asian Games in India? ‘Yes’ because it enhanced the prestige of India in World Community. ‘No’ because India had to spend a huge amount of money on these games.
a) Only argument ‘Yes’ is correct
b) Only argument ‘No’ is correct
c) Both ‘Yes’ and ‘No’ are correct
d) Neither ‘Yes’ nor ‘No’ are correct

49. Spot the stranger in following -
   a) Cricket     b) Foot ball     c) Hockey     d) Chess

50. As sorrow is to death happiness is to?
   a) Birth     b) Wealth     c) Health     d) Home

51. Ram, Shyam and Mohan have invested Rs, 3000/-, 2500/-, and 1750/- in a business. After one year, they gain a profit of Rs. 4930/-. What will be Mohan’s share from the profit?
   a) Rs. 1,190/-       b) Rs. 1,400/-       c) Rs. 1,240       d) Rs. 1,700/-

52. The year 1943 is important because-
   a) Azad Hind Fauj was formed
   b) World War II ended
   c) Quit India Resolution was passed by the National Congress
   d) India Republic day

53. If steam is to Engine then pen is to...........?
   a) Paper     b) Ink     c) Hand     d) Pencil

54. Amit has left his house which is in North and stops at a crossing. On his left is a Zoo. He has to go to his College. Up straight is a long river. What side is his college?
   a) North     b) South     c) East     d) West
55. In an auditorium, 1/4 of the seats were occupied by Boys and 3/8 by Girls. What is the percentage of the children in the audience?

   a) 63%                      b) 62.2%               c) 62.5%            d) 64.5%

56. Which is the odd man out in 49, 91, 47, 112, 133 and 154?

   a) 47                          b) 133                  c) 49                   d) 154

57. Find the odd man out......................

   a) Carpenter                b) Tailor                 c) Table               d) Engineer

58. There are two taps in a water drum. One fills it in 12 hours and the other empties it in 9 hours. If both the taps are opened together then how much time will it take for the drum to fill up?

   a) 8 Hours                                               b) 10 Hours
   c) 18 Hours                                             d) it will never fill up

59. The policy of ‘Non-Violence’ a wise Course? ‘Yes’ because violent will rest in greater violence. ‘No’ because non-violence is the weapon of the weak

   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ is correct
   d) Neither ‘Yes’ nor ‘No’ is correct

60. The year 1885 is regarded important in Indian history because -

   a) Mahatma Gandhi was born
   b) Indian National Congress founded
   c) Arya Samaj was founded
   d) Swami Vivekananda was born
61. A and B facing each other are standing on two different poles where the difference is 600 meters. A walks at a speed of 10 meters a minute and B walks 20 meters a minute. After what time would they meet each other?

   a) 30 minutes         b) 20 minutes
   c) 60 minutes         d) 50 minutes

62. Should students take part in politics? ‘Yes’ because this will serve as a training for them. ‘No’ because they will ignore their studies.

   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
   c) Both ‘Yes’ and ‘No’ are correct
   d) Neither ‘Yes’ nor ‘No’ is correct

63. Ram drives his Scooter at a speed of 30 miles per hour and takes ten minutes rest after one hour. If he has to cover 110 miles, then how much time will he take, if he starts at 10.30 A.M. from his house?

   a) 3.15 hours         b) 3 hours           c) 3.45 hours           d) 3.30 hours

64. Admiral is to Sailor as General is to.............?

   a) Army                     b) Air Force         c) Soldier                d) Chief

65. If 5 x 71 = 14, 42 x 23 = 55, 37 x 44 = 80 then what will be 54 x 32?

   a) 87                          b) 54                     c) 100                      d) 45

66. Should a father force his children to adopt his lifestyles? ‘Yes’ because the experience of the father will help the children to follow the right path. ‘No’ because every individual has his own way to grow up.

   a) Only argument ‘Yes’ is correct
   b) Only argument ‘No’ is correct
c) Both ‘Yes’ and ‘No’ are correct  
d) Neither ‘Yes’ nor ‘No’ is correct  

67. One can get good marks in Examination, if -  

a) One has good handwriting  
b) One’s parent is in the Education Department.  
c) One learns the lessons and pays attention in the class  
d) One is allowed to copy  

68. Were our ancestors happier than us? ‘Yes’ because life was not fast as today and nor did they have so much mental strains. ‘No’ because they did not have so much luxurious life as we enjoy.  

a) Only argument ‘Yes’ is correct  
b) Only argument ‘No’ is correct  
c) Both ‘Yes’ and ‘No’ are correct  
d) Neither ‘Yes’ nor ‘No’ is correct  

69. If court is to justice then auditor is to ...............?  

a) Government b) Product c) Accuracy d) Boys  

70. Should strikes be banned in the Colleges? ‘Yes’ because strikes cause a lot of inconvenience and loss of time for studying. ‘No’ because this is the only method of getting grievances reduced.  

a) Only argument ‘Yes’ is correct  
b) Only argument ‘No’ is correct  
c) Both ‘Yes’ and ‘No’ are correct  
d)Neither ‘Yes’ nor ‘No’ is correct
Appendix 1b

Scoring Key of GITHSS

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Appendix 2a

Jer-Re’s Achievement Test on Chemical Bonding (JATCB)

(Preliminary Draft)

1. Which is surrounding the nucleus in an atom?
   a) Negatively charged ion          b) Positively charged ion
   c) Proton                               d) Neutron

2. Atoms combine together to form a ________________.
   a) Relation                   b) Octet               c) Molecule               d) ions

3. Strong force of binding between two or many atom is referred to as a ____________.
   a) Covalent bond         b) Chemical bond
   c) Ionic bond          d) Electronic bond

4. Which is necessary to form a molecule?
   a) One atom            b) One bond
   c) Two bonds             d) Two or more atoms

5. Which one of the molecule is having two identical atoms?
   a) CO                      b) HCl                    c) P₄                   d) H₂

6. An example for homo nuclear diatomic molecule is ____________.
   a) O₂                       b) HCl                   c) HBr                  d) S₈

7. Which of the following is a hetero nuclear diatomic molecule?
   a) HCl                      b) N₂                       c) Cl₂                  d) Br₂

8. Poly atomic molecule is formed by
   a) Two atoms                    b) One atom
9. Which of the following cannot exist as atom?
   a) O                       b) Ne                     c) He                   d) Ar

10. What is the ionic charge of Calcium ion?
    a) 1+                       b) 2+                     c) 3+                   d) 4+

11. Among the following which cannot exist?
    a) He₂                     b) O₂                     c) N₂                   d) Cl₂

12. Chemical bonds are basically classified into
    a) Three types           b) Two types
    c) Four types           d) Many types

13. Ionic bond is otherwise called as
    a) Electrovalent                b) covalent
    c) Coordinate covalent                d) Metallic

14. During chemical bonding which of the following electron is taking part?
    a) Valance electrons               b) Inner electrons
    c) Inert electrons                 d) none of the above

15. How many electrons are present in the outermost shell of Fluorine?
    a) 10                          b) 15                         c) 6                         d) 7

16. Theory of Chemical bonding was developed by
    a) Kossel and Lewis              b) Albert
    c) Rutherford                                  d) Hess

17. Theory of Chemical bonding was developed in
    a) 1980                       b) 1916                    c) 1956                    d) 1890

18. Which of the following doesn’t show valance shell of eight electrons?
    a) Ne                          b) Ar                     c) He                   d) Xe

19. Atoms have eight electron is known by
a) octet rule  
b) Hund's rule  

c) Inert pair effect  
d) Biuret rule  

20. In the periodic table halogens are  

a) highly electro positive  
b) highly electro negative  

c) highly complexive  
d) highly tendative  

21. Which of the following is highly electropositive?  

a) alkali metals  
b) noble gas  

c) transition metals  
d) f-block metals  

22. Negative ion from a halogen atom is formed by  

a) gain of electron  
b) loss of electrons  

c) both a and b  
d) none of the above  

23. Positive ion from an alkali metal atom is associated with  

a) loss of electron  
b) gain of electron  

c) both a and b  
d) none of the above  

24. How many outer most electrons are there in helium?  

a) Two  
b) eight  
c) four  
d) ten  

25. Negative and positive ions are stabilized by force of  

a) Electrostatic attraction  
b) columbic attraction  

c) ionic attraction  
d) pairing  

26. Octet electron is represented by  

a) ns²np⁶  
b) ns²np³  
c) ns²np⁴  
d) ns²np⁵  

27. NaCl is an ____________ compound.  

a) Ionic  
b) covalent  

c) metallic  
d) coordinate  

28. Which of the following is inert gas?
29. Sodium loses one electron and attains the configuration of __________
   a) Neon                      b) Xenon
   c) Aluminium                 d) Oxygen

30. Mutual sharing of valance electrons between atoms is termed as
   a) covalent bonding          b) Ionic bonding
   c) Mutual bonding           d) bi-bonding

31. Which of the following has the highest electro negativity?
   a) Alkali metals            b) Halogens
   c) Noble Gases              d) Alkaline Earth Metals

32. How many double bonds are seen in Co$_2$?
   a) two                      b) one
   c) three                    d) four

33. The eight outer shell electrons are termed as
   a) biset electron           b) covalent electron
   c) Octet electron          d) both a and b

34. Sodium atom loses an electron to attain the configuration of ______.
   a) Ar                        b) Xe
   c) Mg                        d) Ne

35. Which of the bond is formed if the two atoms share a pair of electrons?
   a) single bond               b) double bond
   c) triple bond               d) Ionic bond

36. Double bond is formed by the sharing of
   a) a pair of electrons       b) two pairs of electrons
   c) three pairs of electrons  d) none of the above

37. Which of the following is the crystalline solid?
   a) SiCl$_4$                  b) I$_2$
   c) LiBr                      d) CH$_4$

38. Which of the following molecule has a triple bond?
a) He₂  b) N₂  c) NH₃  d) O₂

39. Which is having two electrons in the outermost shell?
   a) K  b) P  c) He  d) Li

40. How many electrons are present in the outermost shell of Chlorine atom?
   a) 7  b) 9  c) 3  d) 5

41. If the pair of electrons being donated is by only one atom the type of bond is
   a) Co-ordinate bond  b) Ionic bond
       c) Covalent bond  d) Co-ordinate covalent bond

42. The force of attraction existing in Ionic bond is
   a) electrostatic  b) Lattice
       c) columbic  d) Vander walls

43. Which of the following is the covalent compound?
   a) MgO  b) Al₂O₃  c) F₂  d) Ni(CO)₄

44. Which of the following has low melting point?
   a) N₂  b) C₆H₆  c) LiCl  d) CaO

45. Which is having low dielectric constant?
   a) Benzene  b) Methane
       c) Ammonia  d) Boron Trioxide

46. Which type of bond is present in CaO?
   a) Ionic  b) covalent
       c) metallic  d) both a and b

47. In MgF₂ Magnesium has how many positive charges
   a) three  b) two  c) four  d) one

48. How many positive charges are present in Al in AlBr₃?
   a) Four  b) three  c) two  d) five
49. In which compound mutual sharing of electron takes place?
   a) I₂  b) PH₃  c) C₆H₆  d) BF₃

50. In which molecule electrons are shared unequally?
   a) H₂O  b) Cl₂  c) F₂  d) O₂

51. The electro negativity of inert gases is
   a) 1  b) 0  c) 3  d) 4

52. Which of the following has high melting point?
   a) KCl  b) Cl₂  c) BF₃  d) O₂

53. Which of the following is the good conductor of electricity?
   a) LiCl  b) BF₃  c) F₂  d) HCl

54. Which of the following is soluble in water?
   a) Cl₂  b) O₂  c) KCl  d) AlCl₃

55. Metallic bonds are formed by the attraction of metal ions and __________.
   a) Cations  b) Anions  c) Delocalized electrons  d) Neutrons

56. Which of the following forms the metallic bond?
   a) Cl₂  b) P  c) C  d) Fe

57. Metals are good conductors of heat due to
   a) negative ion  b) positive ion
   c) proton  d) fast moving electrons

58. The ions in the ionic solids are not free to move because of the
   a) strong electrostatic force  b) low electrostatic force
   c) lower latent heat  d) higher solubility

59. According to Fajans rule if the size of the cation is small it forms _______.
   a) covalent bond  b) ionic bond
60. Ionic compounds are considered as
   a) non – polar    b) polar
   c) free          d) close

61. What is the ionic radius of Cl⁻?
   a) 2.3 Å          b) 2.7 Å
   c) 1.81 Å         d) 0.5 Å

62. Covalent bond is formed due to
   a) sharing of electron    b) donation of electron
   c) pairing of electron    d) none of the above

63. Hydrogen molecule is formed due to the overlap of the
   a) two ‘s’ orbitals      b) two ‘p’ orbitals
   c) two ‘d’ orbitals      d) two ‘f’ orbitals

64. Which of the following has the highest covalent character?
   a) NaCl                 b) LiCl
   c) KCl                  d) RbCl

65. Which of the following has the smaller size?
   a) Na⁺                  b) Rb⁺
   c) Cs⁺                  d) K⁺

66. Which of the following has the lowest polarizing power?
   a) LiF                  b) RbF
   c) KF                   d) NaF

67. How many covalent bonds are present in phosphine?
   a) three                b) two
   c) four                 d) one

68. The atomic number of silicon is
   a) 11                    b) 17
   c) 12                    d) 14

69. Covalent compound possess
   a) low melting and boiling points
   b) high melting and boiling points
   c) low melting and high boiling points
70. VSEPR theory was proposed in _____________
   a) 1920                          b) 1960                      c) 1940                  d) 1915

71. The phenomenon of deformation of anion by a cation is known as
   a) polarization                        b) delocalization
   c) stabilization                       d) none of the above

72. Greater the polarization of anion in a molecule more is the _____________ character.
   a) covalent                                  b) Ionic
   c) crystalline                               d) metallic

73. The polarizing capacity of a cation is related to its
   a) atomic size                                      b) atomic charge
   c) ionic potential                                d) radii

74. The general trend in the polarizing power of cations is
   a) Li$^+$$>$Na$^+$$>$K$^+$$>$Rb$^+$$>$Cs$^+$
   b) Li$^+$$<$Na$^+$$<$K$^+$$<$Rb$^+$$<$Cs$^+$
   c) Li$^{2+}$$>$Na$^{2+}$$>$K$^{2+}$$>$Rb$^{2+}$$>$Cs$^{2+}$
   d) Li$^{2+}$$<$Na$^{2+}$$<$K$^{2+}$$<$Rb$^{2+}$$<$Cs$^{2+}$

75. The geometry of BF$_3$ molecule is
   a) Linear                                                     b) Trigonal planar
   c) Tetrahedral                                            d) Octahedral

76. AlCl$_3$ is a covalent molecule in the
   a) ionized state                                            b) free state
   c) mobile state                                           d) stabilized state

77. In HF, the shared electron pair is displaced towards
   a) Hydrogen               b) Fluorine                  c) HF                    d) H$^+$

78. Covalent bond causes fractional charges on the atom due to
79. VSEPR theory was proposed by
   a) Werner b) Sigdwick and Powell
c) John Dalton d) Holler

80. AlCl₃ behaves as an ionic molecule in
   a) ether b) water
c) acetone d) CCl₄

81. The geometry of NH₃ molecule is
   a) Bent b) Linear
c) Tetrahedral d) Trigonal pyramidal

82. The bond angle in SO₂ is
   a) 120° b) 119.5° c) 180° d) 107°

83. In NH₃ the bond angle is
   a) 107° b) 120° c) 119.5° d) 109.28°

84. If overlapping of orbitals occur along the internuclear axis the bond is
   a) π b) σ c) σ* d) π*

85. In water the HOH bond angle is
   a) 104.5° b) 107° c) 119.5° d) 104°

86. The two bonds in oxygen molecule is
   a) 2σ b) 1σ, 1π c) 2π d) 2δ

87. The Lateral overlap of ‘p’ orbitals above and below the axis together is called ____________
   a) π bond b) σ bond c) δ bond d) □ bond

88. The geometrical arrangement of SF₆ molecule is
   a) Tetrahedral b) Linear
89. The electronic configuration of Beryllium is
   a) $1s^22s^2$  
   b) $1s^22s^22p^1$  
   c) $2s^22p^1$  
   d) $1s^22p^2$

90. The electronic configuration of Boron is
   a) $1s^22s^22px^1$  
   b) $1s^22s^22py^1$  
   c) $1s^12s^12px^2$  
   d) $1s^22s^22px^2$

91. The electronic configuration of carbon is
   a) $1s^22s^22px^2$  
   b) $1s^22s^22pz^2$  
   c) $1s^22s^22py^2$  
   d) $1s^22s^22px^12py^1$

92. Beryllium is expected to behave like a
   a) Oxygen gas  
   b) Noble gas  
   c) Nitrogen gas  
   d) Flourine gas

93. In case of Boron VB theory predict
   a) bivalency  
   b) univalency  
   c) trivalency  
   d) octect

94. In practice Boron is
   a) univalent  
   b) bivalent  
   c) trivalent  
   d) pentavalent

95. Name an organic compound which undergoes sp$^2$ hybridization?
   a) Benzene  
   b) BF$^3$  
   c) BeCl$_2$  
   d) LiCl

96. The valency of carbon is
   a) 2  
   b) 1  
   c) 3  
   d) 4

97. The four bonds of carbon to be
   a) unequivalent  
   b) equivalent  
   c) degenerate  
   d) localized
98. The four bonds in carbon are __________ oriented
   a) trigonally  b) tetrahedrally  c) doubly  d) singly

99. Hybridisation means
   a) mixing of orbitals  b) separation of orbitals  c) union of orbitals  d) both a and b

100. The sp\(^2\) hybridized molecule has the following geometry
   a) Trigonal planar  b) Tetrahedral  c) Linear  d) Octahedral

101. Mixing of orbitals to form new orbitals explains the different
   a) geometries  b) figures  c) size  d) volume

102. How many resonance structures are possible for NO\(_3^-\) ion?
   a) 4  b) 2  c) 3  d) 5

103. The molecule which is having the geometry of trigonal bipyramidal is due to the hybridization
    of __________.
    a) sp  b) sp\(^2\)  c) sp\(^3\)  d) sp\(^3\)d

104 The number of nodes in ns orbital is
    a) n-2  b) n+2  c) n-1  d) n-3

105. How many canonical forms are present in ozone?
    a) one  b) three  c) two  d) four

106. The energy released in the formation of LiF is
    a) 77KJ  b) -617KJ  c) 520KJ  d) 310 KJ

107. How many canonical forms are present in CO\(_3^{2-}\)?
    a) 1  b) 2  c) 3  d) 4

108. A number of structures with similar energy are called
    a) canonical structure  b) dot formula
109. N₂O molecule has ____________ canonical forms.
   a) 1   b) 2   c) 3   d) 4

110. Which of the following is having low bond angle?
   a) SO₂   b) NH₃   c) CH₄   d) H₂O

111. What is the valence shell electronic configuration of nitrogen?
   a) 1s²2s²   b) 1s²2s²2p¹
   c) 1s²2s²2pₓ¹2pᵧ¹2pᶻ¹   d) 1s²2s²2p⁶

112. The bond formed between the donar and acceptor atoms is called as
   a) Dative bond   b) Covalent bond
   c) Ionic bond   d) Metallic bond

113. The electronic configuration of magnesium is
   a) 1s²2s²   b) 1s²2s²2p⁶3s²
   c) 1s²2s²3s²   d) 1s²2s²2p¹

114. Coordinate bond between NH₃ and BF₃ molecule is represented as
   a) F₃B→NH₃   b) H₃N→BF₃
   c) BF₃→NH₃   d) NH₃→BF₃

115. In nitro methane one of the N-O bond exist in a
   a) Covalent coordinate type   b) Ionic type
   c) Covalent type   d) Ionic covalent type

116. Who discovered the scale of electro negativity?
   a) Linus Pauling   b) Einstein
   c) Rutherford   d) Thomson

117. Dipole moment is expressed in ____________ unit.
   a) Debye   b) SI   c) Moles   d) KJ
118. Who explained the formation of covalent bond?
   a) Pauling  
   b) Hess  
   c) Sidwick  
   d) Johnson

119. How many electrons are gained by Nitrogen atom to form the octet?
   a) 3e⁻  
   b) 7e⁻  
   c) 2e⁻  
   d) 4e⁻

120. The net dipole moment of BF₃ is
   a) 3  
   b) 1  
   c) 2  
   d) 0

121. The dimeric form of Aluminium Chloride is
   a) Al₂Cl₃  
   b) Al₄Cl₆  
   c) Al₂Cl₆  
   d) AlCl₆

122. Which type of geometry is possible for Nickel tetra carbonyl?
   a) Square pyramid  
   b) square planner  
   c) tetrahedral  
   d) Linear

123. The formula of Nickel tetra carbonyl is
   a) Ni(CO)₄  
   b) Ni₂(CO)₄  
   c) Ni₄(CO)₄  
   d) Ni(CO)₅

124. If ΔE is greater than 1.8 it is called __________.
   a) ionic bond  
   b) covalent bond  
   c) dative bond  
   d) non polar covalent bond

125. Co-ordinate compounds are soluble in
   a) water  
   b) benzene  
   c) ether  
   d) alcohol
## Appendix 2b

### Item Analysis of JATCB

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The symbol Y indicates the selected items.

*Appendix 2c*

Scoring Procedure of JATCB
The respondents had to choose any one of the four multiple choices for all the 100 items. A score of 1 was given for the right response and a score of 0 was awarded for the wrong response. If the question was left unanswered it was given only 0 score. Thus the total score of JATCB is obtained for all the items.

The answers were scored in the following manner as shown below:

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### Formulae Used for Tool Construction

1) The difficulty index is calculated using the formula

\[ \text{Difficulty Index} = \frac{R_u + R_l}{N_u + N_l} \times 100 \]

where,

- \( R_u \) – Number of right responses in the upper group
- \( R_l \) – Number of right responses in the lower group
- \( N_u \) - Number of respondents in the upper group
- \( N_l \) - Number of respondents in the lower group

2) The discriminative index is calculated using the formula

\[ \text{Discriminative Index} = \frac{R_u - R_l}{N_u} \]

3) In the split half method, the test is divided into two equivalent halves and the correlation (r) is found for these half-tests using the formula

\[ r = \frac{N \sum XY - \sum X \sum Y}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}} \]
where,

\[ N \] - Size of the Sample

\[ X, Y \] - Raw Scores

4) From the reliability of the half-test, the self-correction of the whole test is given by the Spearman-Brown prophecy formula which is given below

\[ r' = \frac{2r}{1+r} \]

Appendix 2d

Jer-Re’s Achievement Test on Chemical Bonding (JATCB)

(Final Draft)

1. Which is surrounding the nucleus in an atom?
   a) Negatively charged ion  
   b) Positively charged ion  
   c) Proton  
   d) Neutron

2. Atoms combine together to form a ________________.
3. Which is necessary to form a molecule?
   a) One atom       b) One bond
   c) Two bonds      d) Two or more atoms

4. Which one of the molecule is having two identical atoms?
   a) CO          b) HCl        c) P₄        d) H₂

5. An example for homo nuclear diatomic molecule is _____________.
   a) O₂          b) HCl        c) HBr       d) S₈

6. Which of the following is a hetero nuclear diatomic molecule?
   a) HCl         b) N₂         c) Cl₂       d) Br₂

7. Poly atomic molecule is formed by
   a) Two atoms    b) One atom
   c) Three atoms  d) Many atoms

8. Which of the following cannot exist as atom?
   a) O            b) Ne         c) He        d) Ar

9. What is the ionic charge of Calcium ion?
   a) 1+          b) 2+         c) 3+        d) 4+

10. Among the following which cannot exist?
    a) He₂         b) O₂        c) N₂        d) Cl₂

11. Chemical bonds are basically classified into
    a) Three types  b) Two types
    c) Four types   d) Many types

12. Ionic bond is otherwise called as
    a) Electrovalent b) covalent
    c) Coordinate covalent d) Metallic
13. During chemical bonding which of the following electron is taking part?
   a) Valance electrons  
   b) Inner electrons 
   c) Inert electrons  
   d) none of the above

14. How many electrons are present in the outermost shell of Fluorine?
   a) 10  
   b) 15  
   c) 6  
   d) 7

15. Theory of Chemical bonding was developed by
   a) Kossel and Lewis  
   b) Albert 
   c) Rutherford  
   d) Hess

16. Which of the following doesn’t show valance shell of eight electrons?
   a) Ne  
   b) Ar  
   c) He  
   d) Xe

17. Atoms have eight electron is known by
   a) octet rule  
   b) Hunds rule 
   c) Inert pair effect  
   d) Biuret rule

18. In the periodic table halogens are
   a) highly electro positive  
   b) highly electro negative 
   c) highly complexive  
   d) highly tentative

19. Which of the following is highly electropositive?
   a) alkali metals  
   b) noble gas 
   c) transition metals  
   d) f-block metals

20. Negative ion from a halogen atom is formed by
   a) gain of electron  
   b) loss of electrons 
   c) both a and b  
   d) none of the above

21. Positive ion from an alkali metal atom is associated with
   a) loss of electron  
   b) gain of electron 
   c) both a and b  
   d) none of the above

22. Octet electron is represented by
23. Which of the following has the highest electro negativity?
   a) Alkali metals  
   b) Halogens  
   c) Noble Gases  
   d) Alkaline Earth Metals

24. The eight outer shell electrons are termed as
   a) biset electron  
   b) covalent electron  
   c) Octet electron  
   d) both a and b

25. Sodium atom loses an electron to attain the configuration of ______.
   a) Ar  
   b) Xe  
   c) Mg  
   d) Ne

26. Which of the bond is formed if the two atoms share a pair of electrons?
   a) single bond  
   b) double bond  
   c) triple bond  
   d) Ionic bond

27. Double bond is formed by the sharing of
   a) a pair of electrons  
   b) two pairs of electrons  
   c) three pairs of electrons  
   d) none of the above

28. Which of the following is the crystalline solid?
   a) SiCl₄  
   b) I₂  
   c) LiBr  
   d) CH₄

29. Which of the following molecule has a triple bond?
   a) He₂  
   b) N₂  
   c) NH₃  
   d) O₂

30. How many electrons are present in the outermost shell of Chlorine atom?
   a) 7  
   b) 9  
   c) 3  
   d) 5

31. If the pair of electrons being donated is by only one atom the type of bond is
   a) Coordinate bond  
   b) Ionic bond  
   c) covalent bond  
   d) co-ordinate covalent bond

32. The force of attraction existing in Ionic bond is
33. Which of the following is the covalent compound?
   a) MgO  b) Al₂O₃  c) F₂  d) Ni(CO)₄

34. Which of the following has low melting point?
   a) N₂  b) C₆H₆  c) LiCl  d) CaO

35. Which is having low dielectric constant?
   a) Benzene  b) Methane  c) Ammonia  d) Boron Trioxide

36. In MgF₂ Magnesium has how many positive charges
   a) three  b) two  c) four  d) one

37. How many positive charges are present in Al in AlBr₃?
   a) Four  b) three  c) two  d) five

38. In which compound mutual sharing of electron takes place?
   a) I₂  b) PH₃  c) C₆H₆  d) BF₃

39. In which molecule electrons are shared unequally?
   a) H₂O  b) Cl₂  c) F₂  d) O₂

40. The electro negativity of inert gases is
   a) 1  b) 0  c) 3  d) 4

41. Which of the following has high melting point?
   a) KCl  b) Cl₂  c) BF₃  d) O₂

42. Which of the following is soluble in water?
   a) Cl₂  b) O₂  c) KCl  d) AlCl₃

43. Metallic bonds are formed by the attraction of metal ions and __________.
   a) Cations  b) Anions
44. Which of the following forms the metallic bond?
   a) Cl₂   b) P   c) C   d) Fe

45. Metals are good conductors of heat due to
   a) negative ion   b) positive ion   c) proton   d) fast moving electrons

46. The ions in the ionic solids are not free to move because of the
   a) strong electrostatic force   b) low electrostatic force   c) lower latent heat   d) higher solubility

47. According to Fajans rule if the size of the cation is small it forms _______.
   a) covalent bond   b) ionic bond   c) metallic bond   d) dative bond

48. What is the ionic radius of Cl⁻?
   a) 2.3 Å   b) 2.7 Å   c) 1.8 Å   d) 0.5 Å

49. Covalent bond is formed due to
   a) sharing of electron   b) donation of electron   c) pairing of electron   d) none of the above

50. Which of the following has the highest covalent character?
    a) NaCl   b) LiCl   c) KCl   d) RbCl

51. Which of the following has the smaller size?
    a) Na⁺   b) Rb⁺   c) Cs⁺   d) K⁺

52. Which of the following has the lowest polarizing power?
    a) LiF   b) RbF   c) KF   d) NaF

53. How many covalent bonds are present in phosphine?
    a) three   b) two   c) four   d) one
54. The atomic number of silicon is
   a) 11          b) 17          c) 12          d) 14

55. VSEPR theory was proposed in _____________
   a) 1920          b) 1960          c) 1940          d) 1915

56. The phenomenon of deformation of anion by a cation is known as
   a) polarization          b) delocalization
   c) stabilization          d) none of the above

57. Greater the polarization of anion in a molecule more is the _____________ character.
   a) covalent          b) Ionic
   c) crystalline          d) metallic

58. The general trend in the polarizing power of cations is
   a) Li\(^+\) < Na\(^+\) < K\(^+\) < Rb\(^+\) < Cs\(^+\)
   b) Li\(^+\) > Na\(^+\) > K\(^+\) > Rb\(^+\) > Cs\(^+\)
   c) Li\(^{2+}\) > Na\(^{2+}\) > K\(^{2+}\) > Rb\(^{2+}\) > Cs\(^{2+}\)
   d) Li\(^{2+}\) < Na\(^{2+}\) < K\(^{2+}\) < Rb\(^{2+}\) < Cs\(^{2+}\)

59. The geometry of BF\(_3\) molecule is
   a) Linear          b) Trigonal planar
   c) Tetrahedral          d) Octahedral

60. AlCl\(_3\) is a covalent molecule in the
   a) ionized state          b) free state
   c) mobile state          d) stabilized state

61. In HF, the shared electron pair is displaced towards
   a) Hydrogen          b) Fluorine          c) HF          d) H\(^+\)

62. Covalent bond causes fractional charges on the atom due to
   a) stability          b) nativity
   c) solubility          d) polarization
63. VSEPR theory was proposed by
   a) Werner  b) Sigdwick and Powell
   c) John Dalton  d) Holler

64. The geometry of NH$_3$ molecule is
   a) Bent  b) Linear
   c) Tetrahedral  d) Trigonal pyramidal

65. The bond angle in SO$_2$ is
   a) 120°  b) 119.5°  c) 180°  d) 107°

66. In NH$_3$ the bond angle is
   a) 107°  b) 120°  c) 119.5°  d) 109.28°

67. In water the HOH bond angle is
   a) 104.5°  b) 107°  c) 119.5°  d) 104°

68. The geometrical arrangement of SF$_6$ molecule is
   a) Tetrahedral  b) Linear  c) Octahedral  d) Pyramidal

69. The electronic configuration of Beryllium is
   a) 1s$^2$2s$^2$  b) 1s$^2$2s$^1$2p$^1$
   c) 2s$^2$2p$^1$  d) 1s$^2$2p$^2$

70. The electronic configuration of Boron is
   a) 1s$^2$2s$^2$2px$^1$  b) 1s$^2$2s$^2$2py$^1$
   c) 1s$^1$2s$^1$2px$^2$  d) 1s$^2$2s$^2$2px$^2$

71. The electronic configuration of carbon is
   a) 1s$^2$2s$^2$2px$^2$  b) 1s$^2$2s$^2$2pz$^2$
   c) 1s$^2$2s$^2$2py$^2$  d) 1s$^2$2s$^2$2px$^1$2py$^1$

72. Beryllium is expected to behave like a
   a) Oxygen gas  b) Noble gas
   c) Nitrogen gas  d) Flourine gas
73. In practice Boron is
   a) univalent  b) bivalent  
   c) trivalent  d) pentavalent

74. Name an organic compound which undergoes sp\(^2\) hybridization?
   a) Benzene   b) BF\(_3\)   c) BeCl\(_2\)   d) LiCl

75. The valency of carbon is
   a) 2  b) 1  c) 3  d) 4

76. The four bonds of carbon to be
   a) unequivalent  b) equivalent  
   c) degenerate  d) localized

77. The four bonds in carbon are _______________ oriented
   a) trigonally  b) tetrahedrally  
   c) doubly  d) singly

78. Hybridisation means
   a) mixing of orbitals  b) separation of orbitals  
   c) union of orbitals  d) both a and b

79. The geometry of sp\(^2\) hybridized molecule is
   a) Trigonal planar  b) Tetrahedral  
   c) Linear  d) Octahedral

80. Mixing of orbitals to form new hybrid orbitals explains the different
   a) geometries  b) figures  
   c) size  d) volume

81. The molecule which is having the geometry of trigonal bipyramidal is due to the hybridization
   of ______________ .
   a) sp  b) sp\(^2\)  c) sp\(^3\)  d) sp\(^3\)d
82. The number of nodes in ns orbital is
   a) n-2  b) n+2  c) n-1  d) n-3

83. How many canonical forms are present in ozone?
   a) one  b) three  c) two  d) four

84. The energy released in the formation of LiF is
   a) 77KJ  b) -617KJ  c) 520KJ  d) 310 KJ

85. How many canonical forms are present in CO$_3^{2-}$?
   a) 1  b) 2  c) 3  d) 4

86. N$_2$O molecule has ____________ canonical forms.
   a) 1  b) 2  c) 3  d) 4

87. Which of the following is having low bond angle?
   a) SO$_2$  b) NH$_3$  c) CH$_4$  d) H$_2$O

88. The bond formed between the donar and acceptor atoms is called as
   a) Dative bond  b) Covalent bond
   c) Ionic bond  d) Metallic bond

89. The electronic configuration of magnesium is
   a) 1s$^2$2s$^2$  b) 1s$^2$2s$^2$2p$^6$3s$^2$
   c) 1s$^2$2s$^2$3s$^2$  d) 1s$^2$2s$^2$2p$^1$

90. Coordinate bond between NH$_3$ and BF$_3$ molecule is represented as
   a) F$_3$B→NH$_3$  b) H$_3$N→BF$_3$
   c) BF$_3$→NH$_3$  d) NH$_3$→BF$_3$

91. Who discovered the scale of electro negativity?
   a) Linus Pauling  b) Einstein
   c) Rutherford  d) Thomson

92. Dipole moment is expressed in ____________ unit.
   a) Debye  b) SI  c) Moles  d) KJ
93. Who explained the formation of covalent bond?
   a) Pauling  
   b) Hess 
   c) Sidwick 
   d) Johnson

94. How many electrons are gained by Nitrogen atom to form the octet?
   a) 3e⁻  
   b) 7e⁻ 
   c) 2e⁻ 
   d) 4e⁻

95. The net dipole moment of BF₃ is
   a) 3  
   b) 1 
   c) 2 
   d) 0

96. The dimeric form of Aluminium Chloride is
   a) Al₂Cl₃  
   b) Al₄Cl₆ 
   c) Al₂Cl₆ 
   d) AlCl₆

97. Which type of geometry is possible for Nickel tetra carbonyl?
   a) Square pyramid  
   b) square planner 
   c) tetrahedral 
   d) Linear

98. The formula of Nickel tetra carbonyl is
   a) Ni(CO)₄  
   b) Ni₂(CO)₄ 
   c) Ni₄(CO)₄ 
   d) Ni(CO)₅

99. If ΔE is greater than 1.8 it is called ________ .
   a) ionic bond  
   b) covalent bond 
   c) dative bond 
   d) non polar covalent bond

100. Co-ordinate compounds are soluble in
     a) water       
     b) benzene  
     c) ether     
     d) alcohol
### Scoring Key for JATCB

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## Content of Package on Chemical Bonding for Computer Assisted Instruction Approach (CPCBCAI)

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| 3   | III. | Types of bonds  
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### for Chemical Bonding

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Appendix 5

Planning and Preparation of Instructional Material for Co-operative Learning

Std: XI

Subject: Chemistry

Topic: Chemical Bonding
Unit: I

Duration: 45 minutes

Objectives

The student

i. develops understanding about chemical bonding and the classification.

ii. applies her knowledge about the content to new situation.

iii. learns to organize and summarize information based on her learning.

iv. learns to work in co-operative groups

Co-operative Learning is a teaching strategy in which small groups of learners each with different levels of ability, use a variety of learning activities to work together as a team to solve a problem, complete a task or accomplish a common goal. In this method, the students listen, argue, discuss, explain and teach in their efforts to help each other and master the academic content presented by the instructor. Each member of a team is responsible not only for learning what is taught but also for helping team-mates to learn and thus creating an atmosphere of achievement.

There are different methods in Co-operative Learning Strategy. Here the investigator used Jigsaw method of Co-operative Learning and prepared the instructional material for the lesson Chemical Bonding.

The following steps were employed in the Jigsaw method.

Step-I: Introduction

The lesson is introduced by the teacher and the students are motivated and encouraged to listen, argue, discuss and learn in groups.

Step-II: Focused Exploration
It includes the following steps.

a) **Formation of groups:**

The teacher divides the Experimental group-II into 10 groups. Each group consists of 5 members called ‘**Base Groups**’ or ‘**Home Groups**’.

b) **Task Assigned:**

The teacher assigns individual works based on the lesson to each member of each base group. The students in each base group are named as A₁, A₂, A₃, A₄, & A₅. They are given the following topics to learn in groups.

- A₁: Definition of Chemical Bonding
- A₂: Elementary theories on chemical bonding
- A₃: Classification of molecules
- A₄: Classification of Chemical Bonding
- A₅: Octet rule

c) **Working in the Group:**

From the base groups those who get the same topics again form another groups known as ‘**Expert Groups**’. In the expert groups they learn and master the area assigned to them with the help of the teacher getting their doubts clarified. While students are working in groups the teacher goes around and observes each group and acts as a facilitator and helps them to attain the mastery level.

**Step-III: Reporting and Reshaping**

The students return to their original groups and instruct to their team-mates what they learn in their expert groups.

**Step-IV: Integration**
The groups connect the various pieces of information generated by the individual members and integrate into the whole regarding the classification of molecules and chemical bonding. The expert students patiently explain each concept to weaker students and check whether their team-mates follow the explanation.

**Step-V: Evaluation**

To test whether the students have learnt the material well or not, the teacher asks review questions and elicits answers with the base groups. A quiz on the material is given to the students so as to make sure that they have attained mastery over the content.

**Questions for Quiz:**

1. What is the atomic number of sodium?
2. When an electron is gained which ion is formed?
3. How many electrons are there in the outermost shell of chlorine atom?
4. Can ionic compound conduct electricity?
5. Give one example for cation?