# Sample Question paper

## Integrated M.S. Programme    -    Entrance test

The **Large Hadron Collider** (**LHC**) is the world's largest and highest-energy particle accelerator intended to collide opposing particle beams of either protons at an energy of 7 TeV per particle or lead nuclei at an energy of 574 TeV per nucleus. It lies in a tunnel 27 kilometres (17 mi) in circumference, as much as 175 metres (570 ft) beneath the Franco-Swiss border near Geneva, Switzerland.



1. One of the objectives of the Large Hydron Collider experiment is to detect

    a. Fermion   b. Electron   c. Plasmon       d. Higgs boson

2. The velocity of the accelerating particle for collision is

    a.  $c$              b.  $< c$            c.  $= c$            d. The velocity of the electron

3. The following fundamental particle has no mass

    a. Electron       b. Proton       c. Positron       d. Photon

4. The universe has dimension for the standard model

    a. One            b. Three            c. Four          d. Ten

5. The constituent of the protons are

    a.Mesons          b Neutrons       c Tachions        d.Quarks

6. The first element evolved according to BigBang Theory is

    a. Hydrogen       b. Helium          c. Deuterium    d. Tritium

7. The following particles do not need a medium to travel

    a. Photons       b. Phonons       c. Electrons       d. Plasmon

8. A stone thrown up comes back, but a rocket goes up due to

    a. Gravity on the rocket b. Velocity of the rocket

    c. Mass of the rocket            d. Spin of the rocket

9. The electricity in a dam is produced from

    a. Translational energy  b. Vibrations of water

    c. Potential energy of water       d. Kinetic energy of water

**Chandrayan.**

Understanding the moon provides a pathway to unravel the early evolution of the solar system and that of the planet earth. Chandrayaan-1, India's first mission to Moon, was launched successfully on

October 22, 2008 from SDSC SHAR, Sriharikota. The spacecraft was orbiting around the Moon at a height of 100 km from the lunar surface for chemical, mineralogical and photo-geologic mapping of the Moon. The spacecraft carried major 11 scientific instruments built in USA, UK, Germany, Sweden and Bulgaria. However on 30th August the ISRO abruptly lost contact with Chandrayaan-1 at 01.30 AM. Thus the mission has come to an end in ten months instead of its slated life of two years. Given below is a press release in this connection.

*A day after the ground-breaking discovery of water on the moon hit the headlines, Chairman of the Indian Space Research Organisation (ISRO). G. Madhavan Nair on Friday said the Chandrayaan-1 detected water on the lunar surface as early as June 2009.*

*The indigenously developed Moon Impact Probe (MIP), which crash-landed at a designated site on the lunar south pole on November 14, 2008, picked up "clear signatures" of water during its 25-minute descent, Mr. Nair said at a press conference here on Friday.*

*Analysis of the data from a mass spectrometer on the MIP pointed to the presence of water. The cuboid probe also bore the Tricolour, thus "planting the Indian flag" on the moon when it landed.*

*This finding was later "confirmed" by the Moon Mineralogy Mapper (M3), which was supplied by the United States. While ISRO knew about water presence "way back in June" it waited for the findings of the M3 to be published in Science this week before announcing it, Mr. Nair said.*

*Being the nearest object to the earth, the moon could become a base for space exploration and a resource not just for water but also for fuel, said Mr. Nair when asked about the significance of the finding. "It was also a fine example of how the international scientific community can work together."*

*The image of the moon beamed by the Moon Mineralogy Mapper, shows a three-color composite of reflected near-infrared radiation from the sun. Small amounts of water and hydroxyl (blue) were detected on the surface at various locations and this image illustrates their distribution at high latitudes toward the poles. Blue shows the signature of water and hydroxyl molecules, green the brightness of the surface and red an iron-bearing mineral called pyroxene*

**Based on the text given above Mark whether the following statements are True/ False(10-17) (Write "T" for True and "F" for False statements in the column and write the answer for the question No.18 in the column provided for it).**



10. Both M3 and MIP are Same
11. The signals received from M3 and MIP are identical
12. The MIP has stopped giving signals much before the failure of Chandrayaan
13. Usage of "hydroxyl molecules" is wrong
14. The mass instrument attached on the MIP is indigenously made.
15. The presence of water in the moon first detected by the Chandrayaan mission
16. The ground breaking discovery of water on the moon was announced first by NASA based on the images obtained from M3.
17. The ground breaking discovery of water on the moon was announced first by ISRO on the basis of the information obtained from MIP.

18. In future moon can be a resource for water and fuel. Name a fuel which can be obtained from the moon with the present knowledge

19. The atmosphere of the Moon is

     a. Same as earth      b. Same as Mars

     c. Contains Oxygen      d. Same as Vacuum

20. Calculate the speed at which the Chandrayan orbiter left earth orbit on its journey to the moon

   Mass of Moon = 7.35 x $10^{22}$ Kg

   Mass of earth = 5.9 x $10^{24}$ Kg

   Radius of the Moon = 1.738 x $10^{6}$ m

   Radius of the earth = 6.37 x $10^{6}$ m

   Distance to the moon = 3.8 x $10^{8}$

   Universal constant of Gravitation G = 6.67x $10^{11}$ SI units

     a. $11.2\sqrt{G}$ kms$^{-1}$      b. $1.37$x$10^{9}$ $\sqrt{G}$ ms$^{-1}$

     c. $\frac{11.2}{\sqrt{G}}$ kms$^{-1}$      d. $1.37$x$10^{9}$ G ms$^{-1}$

21. The gravitational pull on the moon is

     a. > g      b. < g      c. = g      d. None of the above

22. The elements have no atomic number greater than 250 because

     a. The first orbit of the electron enters the nucleus

     b. The proton and electrons interact among themselves

     c. There is no orbit for the electron to occupy

     d. Pauli's exclusion principle

23. A fireman of 80 Kg slides down a pole. If the resisting force of friction is a constant 720N his acceleration is

     a. 1      b. 0.8      c. 0.8      d. 0.01

24. The Mass instrument attached to the Moon Impact Probe showed a signal at ---- a clear clue for the presence of water.

     a. 12      b. 17      c. 16      d. 27

25. The famous iron pillar in Delhi erected in the Gupta period stands erect without deterioration. The approximate chemical composition of this corrosion resistant iron pillar is Iron (major), Silicon, Phosphorus, sulfur and element X ( second major).

   The element X is

     a. Aluminium      b. Tin      c. Carbon.      d. Cadmium

26. From the given ancient knowledge centers identify the one which was active in the Gupta Period

   (a) Nalanda,   (b) Thakshashila, (c) Library of Alexandria (d) Plato's academy

27. Mention about a few metals like gold, silver, iron, copper, lead, tin and mercury are there even in the *Charaka Simhita* – a medical treatise of ancient India. Each of these metals was

associated with a particular *heavenly* body like Sun, Moon, Mars, Venus, Saturn, Jupiter and Mercury.

Match the element with the Heavenly bodies.

| | a. | | | b. | | |
|---|---|---|---|---|---|---|
| | Gold | Venus | | Gold | Sun | |
| | Silver | Sun | | Silver | Mars | |
| | Iron | Moon | | Iron | Jupiter | |
| | Cupper | Saturn | | Cupper | Saturn | |
| | Lead | Jupiter | | Lead | Venus | |
| | tin | Mar | | tin | Moon | |

| | c. | | | d. | | |
|---|---|---|---|---|---|---|
| | Gold | Saturn | | Gold | Sun | |
| | Silver | Sun | | Silver | Moon | |
| | Iron | Moon | | Iron | Mars | |
| | Cupper | Venus | | Copper | Venus | |
| | Lead | Jupiter | | Lead | Saturn | |
| | tin | Mars | | Tin | Jupiter | |

28. Magnetic Resonance Imaging (MRI), or nuclear magnetic resonance imaging (NMRI), is primarily a medical imaging technique most commonly used to visualize the internal structure and function of the body.

For the invention leading to this technique Nobel prize were awarded four times. (1952-Physics, 1991-Chemistry, 2002-Chemistry and 2003-Medicine.) In clinical practice, MRI is used to distinguish pathologic tissue (such as a brain tumor) from normal tissue. One advantage of an MRI scan is that it is believed to be harmless to the patient. It uses strong magnetic fields and non-ionizing radiation.

Select the correct radiation from the given list which is used in the technique.

   a. X-rays,      b. Radio waves,    c. Gamma rays     d. Infrared  e.ultraviolet

29.  Mass spectrometry (MS) is an analytical technique for the determination of the elemental composition of a sample or molecule two Nobel prizes (1922 and 2003) were awarded in the field of this instrumentation. The Mass spectrometer on the MIP (Moon Impact Probe) picked up clear "signatures" of water.

   The signature is due to
   a. Scattering property of water
   b. formation of charged particles from water
   c. absorption of electromagnetic radiation by the water
   d. high dielectric constant of water.

30.  The following titles are mile stones in the history of scientific knowledge.
      i. There is plenty of room at the bottom.  ii. Three hundred years of Gravitations
      iii. The origin of species   iv Ideas and opinions v. The nature of chemical bond.

The authors are (i-v)

a. Albert Einstein, Richard  Feynman, Charls Darvin,  Stephen Hawking,  Linus Pauling

b. Linus Pauling,  Albert Einstein, Charls Darvin, Stephen Hawking,  Richard  Feynman

c. Albert Einstein, Richard  Feynman, Charls Darvin,  Linus Pauling, Stephen Hawking

d. Linus Pauling,  Albert Einstein,  Richard  Feynman, Charls Darvin,  Stephen Hawking

e.  Richard  Feynman, Stephen Hawking, Charls Darvin, Albert Einstein, Linus Pauling

Mādhavan of Sangamagramam. (1350 – c. 1425) was a prominent  mathematician-astronomer from the town of Irinjalakkuda, near Cochin, Kerala. He is considered the founder of the Kerala school of astronomy and mathematics. He was the first to have developed infinite series approximations for a range of trigonometric functions, which has been called the "decisive step onward from the finite procedures of ancient mathematics to treat their limit-passage to infinity".[j]His discoveries opened the doors to what has today come to be known as mathematical analysis. One of the greatest mathematician-astronomers of the Middle Ages, Madhava contributed to infinite series, calculus, trigonometry, geometry and algebra. Some scholars have also suggested that Madhava's work, through the writings of the Kerala school, may have been transmitted to Europe via Jesuit missionaries and traders who were active around the ancient port of Kochi at the time. As a result, it may have had an influence on later European developments in analysis and calculus



31.    Rearrange the names given below in the increasing order  of  time scale

i, Isaac Newton ii.  Gottfried Wilhelm Leibniz iii. Archimedes ,iv.  Gauss  v.  Euclid  vi . Galileo and vii .  l'Hôpital viii. Mādhavan of Sangamagramam

a.Vii <  i < ii <viii < iv < v < vi< iii

b.     i < ii < iii < iv < vii < vi < v< viii

c.v < iii < viii  < vi < i  <ii < vii< iv

d.     i < ii < iii < iv < v < iv  < vii<viii

32. The U.S. Food and Drug Administration (FDA) has banned the use of PVC as a

Food packing material because

a.  PVC causes Parkinson's disease    b.  PVC react with the food materials

b.  Traces of vinyl chloride causes liver cancer  d.   Phosgene is generated

33.    The element whose electronic configuration is $1s^2, 2s^2, 2p^6, 3s^2$ is a/an

a. Metalloid      b. inert gas        c. metald. non-metal

34.    The kinetic energy of one gram mole of a gas (assuming ideal behavior) depends on

a. pressure of the gas                b.  Nature of the gas molecules

c. absolute temperature of the gas        d.  Volume of the gas

35. Consider 0.1M solutions of the following salts. The solution that will have the lowest freezing point   is

   a. NaCl   b. $BaCl_2$ c. $Na_2SO_4$       d. $Al(NO_3)_3$

36. In solid $CuSO_4.5H_2O$ copper is coordinated to

   a. one water molecule          b. one sulphate ion

   c. four water molecules d. five water molecules

37. The highest molar conductivity will be exhibited by the complex

   a. $[Cr(NH_3)_6]Cl_3$   b. $[Cr(NH_3)_5Cl]Cl_2$

   c. $[Cr(NH_3)_4Cl_2]Cl$       d. $[Cr(NH_3)_3Cl_3]$

38.     An amorphous solid is heated until it is melted and the heating continued further. If the temperature is plotted against time, nature of the plot should be
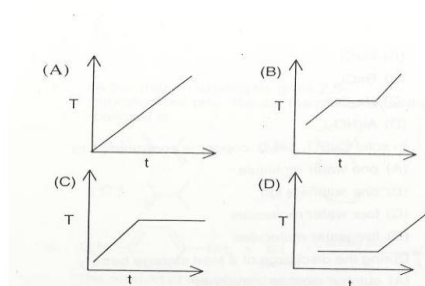


39. The compound that produces a lower pH than sodium carbonate when an equivalent amount is dissolved in water is

   a. NaOH          b. $Na_3PO_4$          c. $NaHCO_3$              d. KOH

40. The compound that gets oxidized on exposure to air is

   a. $Co_2(SO_4)_3$              b.$NiSO_4$              c.$ZnSO_4$          d. $FeSO_4$

41. An example of a redox reaction is

   a. $H_2+Cl_2 \rightarrow 2HCl$        b. $Na_2O + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

   c. $Ag^+(aq) +Cl^-(aq) \rightarrow AgCl(s)$     d. $OH^-(aq) + H^+(aq) \rightarrow H_2O$

42. Which of the following graphs correctly describes the temperature dependence of the velocity (v) of a reaction A$\rightarrow$B occurring in one step
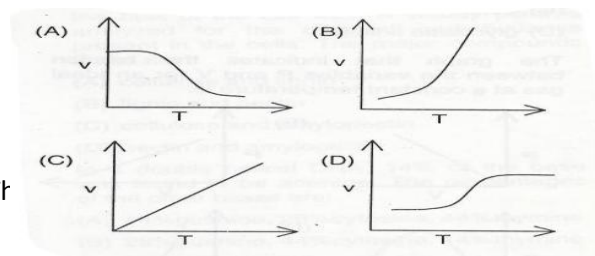


43. Th                                                                $A^0$ size (a = 3.923$A^0$ )

                                                                       120

44. Hydrogen fluoride is a liquid at room temperature due to
   a.   Dimerisation              b. Dissociation followed by aggregation
   c.   Association              d. Polymerization

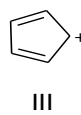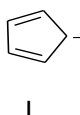45. Number of theoretically possible optical isomers in the following steroid is
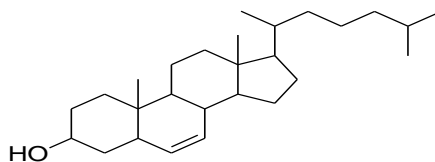
a. 256     b.64     c.8     d.16

46. Match the resonance energies 67,88 and 121 kjmol$^{-1}$ for the following compounds.
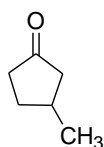


I          II          III

a. I-67, II-121, III-88          b. I-121, II-67, III-88
c. I-67, II-88, III-121          d. I-121, II-88, III-67

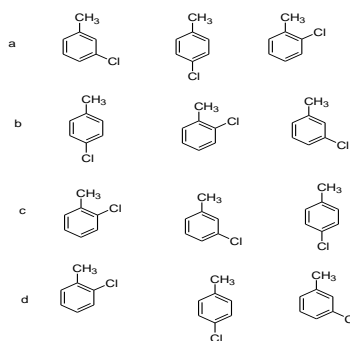47. Identify the aromatic compound from the following



I          II          III          IV
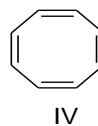
a. I          b. II          c. III          d. IV

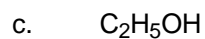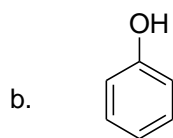48. The product(s) of oxidation of the following compound using alkaline KMnO$_4$ is (are)



49. The set in which isomeric chlorotoluenes have dipole moments 1,3D,1.9D, and 1.78D respectively is



50. The compound having the strongest intermolecular hydrogen bonding is

a. CH$_3$—COOH

b.



c. C$_2$H$_5$OH

d. SiH$_4$
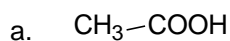
51. The compound that gives iodoform on warming with iodine in an alkaline solution is

a.3-pentanone      b.1-butanol     c. cyclohexane      d. None of the above

52. Choose the most appropriate pair of nitrogen that gets protonated in the following structures
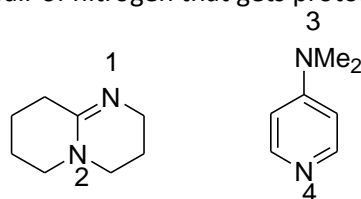


a. 1 &3       b. 2 &4      c.1 &4      d.2 &3

53. Carbon monoxide is prepared from the lowest organic acid, formic acid. Identify the chemical reagent which converts formic acid to CO

a. H$_2$SO$_4$       b. HCl      c. HNO$_3$      d. Acetic acid

54. Arrange the molecules in the increasing order of the acidity of the marked protons.
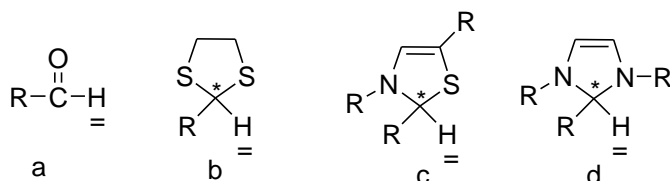


a. c<a<d<b       b. a<d<c<b    c. b<d<c<a       d. a<c<b<d

55. Acetaldehyde reacts with a mixture of KCN and NH$_4$Cl to give a product X which upon hydrolysis yields alanine. The product X is

a. An aminonitrile       b.A cyanohydrins

c. An aminoalcohol       d. A chlorohydrin

56. The orange color of β-carotene is due to

a. Extended conjugation       b. Azo group

c. Charge –transfer complex       d. None of the above
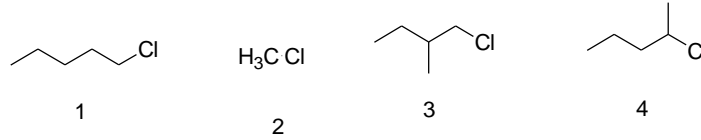
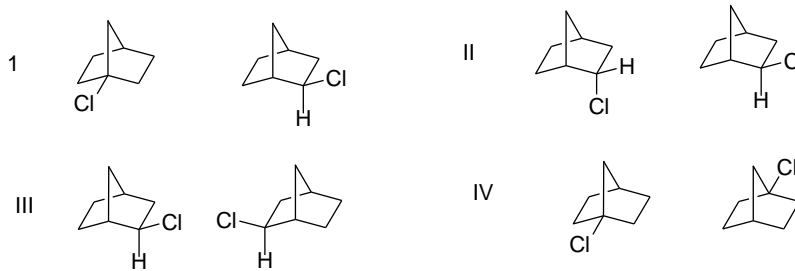57. The following compounds



and
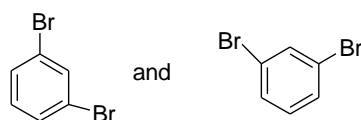
are

a. Optical isomers          b. Positional isomers of each other

c. Structural isomers          d. Identical to each other

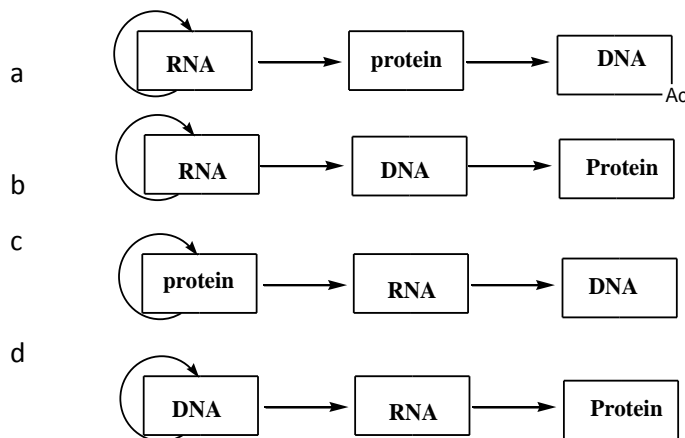58.  Identify the molecule which undergoes (SN2 reaction) faster



1          2          3          4

a.  1          b.2          c.3          d.4

59. The diastereomeric pair among the following pairs  is



a.  I          b. II          c. III          d. IV

60.  Identify the correct  flow chart indicating the central dogma of molecular genetics



61.  A rectangular 1-metre- by- 2-metre water tank being filled at 20 liters per second. How fast is the water level rising

a.2cm/s          b.1cm/s          c. 0.5cm/s          d.4cm/s

62.  What is the units digit of the product of all the primes from 1 to 2009?

a.  0          b. 3          c. 7          d. 1

63.  The factor of a number is defined as that number which will divide into it. A prime number therefore has two factors, 1 and itself; thus a prime number has an even number of factors. The number 32 for instance has 1, 2, 4, 8, 16 and 32 as factors, thus the number of factors it has is 6, again an even number.   An odd number say 55 also has an even number of factors: 1, 5, 11 and

55, giving a total of 4. How many numbers between 1 and your lucky year 2009 will have an ODD NUMBER OF FACTORS?

a. none     b. between 40 and 50   b. between 50 and 100   c. more than 100

64. Three straight lines drawn at random on a plane will divide it into a maximum of how many segments

   a. 3     b. 4     c.6     d.7

65. The differential of $\sin^2 4x$ is

   a. $\sin^2 4x$           b. $\cos^2 4x$           c. $4\sin 8x$           d. $8\sin 4x$

66. The integral of $1/x$ is

   a. $1/x^2$         b. $-1/x^2$           c. $\ln x$       d. $e^x$

67. When we are on a beach, we can see ships moving in the sea far away from the shore. It appears that these ships are small when we observe from shore. Why do far away object looks small?

   a. Light rays from the far away objects bends and appear the object as small

   b. A part of the light get scattered and make the object look small

   c. It is an artifact created by human eye by adjusting the filed of view to see large areas

   d. Intensity of light from far away objects is reduced as it travels long distances through air and make the objects looks smaller

68. A large brake on a bicycle need not be more effective than a smaller one. Why?

   a. Frictional force is independent of area of contact

   b. Braking force is independent of frictional force between brake and rim

   c. Braking force depends on friction force between brake and rim

   d. Large brake on bicycle is more effective

69. White cloths after washing with soap is usually dipped in blue die solutions to get more shining? Why do blue dyes give more shining to white cloths?

   a. Dyes used in blue are shining materials which increases shining

   b. Dyes absorb energy and emit later.

   c. Dyes get absorbed on the cloth strands and these dye molecules converts a part of ultraviolet radiation into visible light and reflect back.

   d. Dyes are florescent materials

70. Biscuits when kept in open air looses crispness after some time. However in refrigerator it is more crispy.. This is because,

   a. Biscuits will absorb less water as the cold air inside the fridge contain lesser moisture

   b. Biscuits is getting colder and hence feeling crispy.

   c. Humidity is less inside the refrigerator.

   d. Due to both b and c

71. A parachutist after jumping from an aircraft falls 50 m without friction. When the parachute opens he decelerates downwards with 2 $m/s^2$. He reaches ground with a speed of 3 m/s.

    How long the parachutist stays in air.

    At what height did he jump?

72 A galvanometer together with an unknown resistance in series is connected across two identical batteries each of 1.5 V. When batteries are connected in series the galvanometer records a current of 1A. When batteries are connected in parallel the galvanometer records 0.6A. What is the internal resistance of the battery?

73. I was driving a car. A doll was hanging from the rear view mirror of the car. On accelerating the car the string hanging the doll makes a constant angle $30^\circ$ with the vertical. What is the value of acceleration of my car?

74. A bus is beginning to move with an acceleration of 1 $m/s^2$. A man who is 40 m behind the bus on the same line starts running with a speed of 9 m/s to catch the bus. After how many seconds will the man be able to catch the bus? Explain the answer.?

75. An object is placed in front of a concave mirror at a distance 7.5 cm from it. If a real image is formed at a distance 30 cm from mirror, find the focal length of the mirror. What would be focal length if image is virtual?

76. The breakthrough that produced some of the chemicals required for the origin of life was first explored experimentally in the early 50's by a young graduate student named Stanley Miller who was working on his Ph.D at the university of Chicago under the guidance of H.C.Urey a noted American chemist who received Nobel prize in chemistry in the year 1934 for his discovery of heavy hydrogen (deuterium).
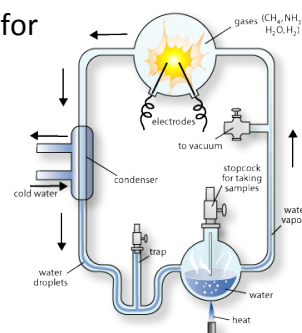
    

    The experiment used water ($H_2O$), methane ($CH_4$), ammonia ($NH_3$), and hydrogen ($H_2$).

    Using the above molecules write a balanced equation for the formation of the amino acid glycine.

77. Aleksandar Mikhailovich Butlero was a Russian chemist, one of the creators of the theory of chemical structure (1857-1861), the first to incorporate double bonds into structural formulas, the discoverer of formaldehyde, and the discoverer of the formose reaction.

    Using formaldehyde and calcium hydroxide it is possible to synthesize carbohydrate. Draw the structure of a carbohydrate formed from six molecules of formaldehyde and calcium hydroxide.

78. Vanillin is the primary component of the extract of the vanilla bean. It is also found in roasted coffee and the Chinese red pine. Synthetic vanillin, instead of natural vanilla extract, is sometimes used as a flavoring agent in foods, beverages, and pharmaceuticals. It has the following structure
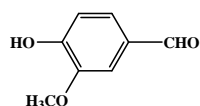
1a.  Mark the reagent that gives a positive test with Vanilin

(A)  Ferric chloride solution    (B) Sodiumnitropruside

(C)  Alcoholic α-naphthol  (D)   Borches reagent

1b.    Vanillin condenses with aniline to give a compound (L) having molecular mass less by 18 of the total molecular mass of the reactants.

The eliminated species is…………………………….

The general name of the class of the compound formed …………………….

The structure of the compound L is ……………………………..

1c. Vanillin condenses with 2-aminophenol in the same way as that of aniline to give a compound (M). It forms a complex with CuCl2 in which the coordination number is 4. The IR band at around 1590cm$^{-1}$ of "M" is shifted to a lower frequency and a new absorption band appears at around 540cm$^{-1}$ in the IR spectrum of the complex. The complex does not give a precipitate with $AgNO_3$ and molar conductance of it in nitrobenzene is negligible.

Draw the tentative structure of the complex.

79.   Show the isoprene units present in the following molecule.
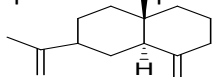


80.   Metal ions or metals as such have very important biological functions. Match the given metals with appropriate class of compounds

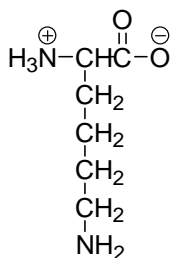| As | | Chlorophyll ( plant pigment) |
|----|---|------------------------------|
| Mg | | Vitamin B$_{12}$ (vitamin) |
| Fe | | Arsphenamine (a medicine) |
| Co | | Hemoglobin (constituent of blood) |

81.

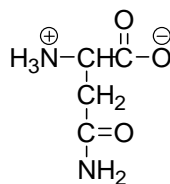82.   Show with structures that phenolate ion has greater resonance stabilization than phenol?

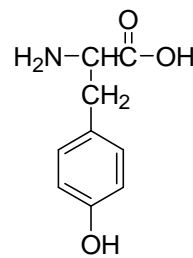83.   Arrange the following amino acids in the increasing order of basicity with proper justification.
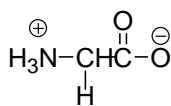


Glycine

Lysine

Aspargine

Tyrosine

84. Identify the True and false statements. (mark T/F)

All coenzymes and enzymes are proteins (…………)

Coenzymes are exclusively synthesized by mammals (…………)

Many essential vitamins are otherwise called coenzymes (…………)

Vitamins can be cofactors and serve as precursors to coenzymes (……..)

A virus consists of both DNA and RNA (…………)

The *E. coli* cell consists of both DNA and RNA (…………)

HIV viruses have single stranded RNA genomes (…………)

85. Write the product of the following reaction?



$$CH_3\overset{O}{\underset{||}{C}}-O-\overset{O}{\underset{||}{C}}CH_3 \xrightarrow[\text{excess benzene,80 }^0C]{AlCl_3}$$
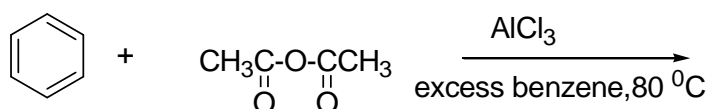
86. Tartaric acid is present in grapes. Citric acid is present in lemon.2-hydroxy citric acid is present in the fruit of Kudampuli. The edible yellow pigment present in turmeric is curcumin. The structure of which is
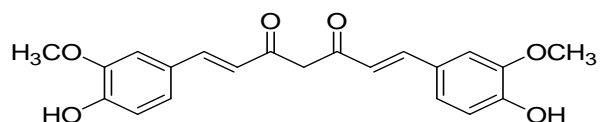


It is widely used in food industry as a coloring agent. When curcumine is treated with borates a deep colored complex is formed. a)Draw the structure of the complex formed?. b)draw the structure of the brownish red colored compound obtained when curcumine is treated with an alkali?
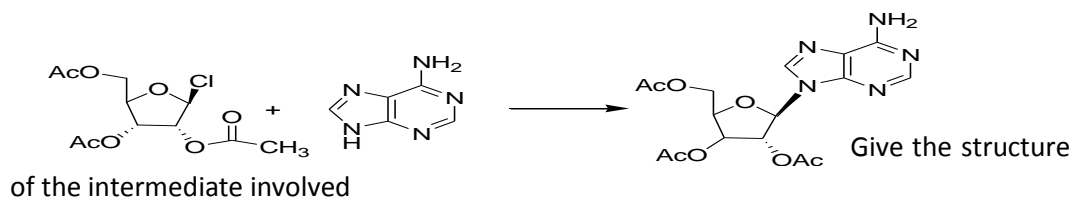
| a) | b) |
|----|----|
|    |    |

87. a) Construct a simple nucleotide using the following nucleic acid base, phosphoric acid and sugar.
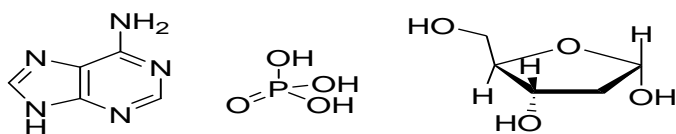


b) Draw the complementary residue of DNA. Using the above nucleotide

c)The given reaction is SN2 type and stereospecific

  Give the structure

of the intermediate involved

d) HIV-1 and HIV-2 are retroviruses (RNA). T4 lymphocytes are the cells primarily responsible for inducing the immune system to respond when provoked. AZT is a drug used against AIDS
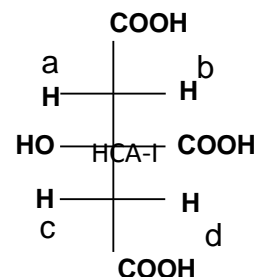
(AZT)
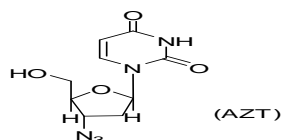
Transcribe A Z T to AID's patient's DNA. Draw the structure of grown nucleotide.

88. Hydroxycitric acid is obtained (HCA1) when one of the marked hydrogen atom (say a-d)  is replaced with –OH in the given molecule (citric acid). These acids are widely distributed in nature.



Exchange of b-H gives HCA-II
Exchange of c-H gives HCA-III
Exchange of d-H gives HCA-IV

Identify the chiral molecules.

89. Imagine you are one among the 10 lucky candidates selected for the MS program at UCIPR, Kottayam. On the first-day program in the main hall, in addition to the ten of you, there are four faculty members and three distinguished guests. So far so good. Now read on…

(i) How many handshakes will you need to give if you don't shake hands with any person more than once? Don't shake hands with yourself!!

(ii) How many handshakes will there be in total in the room if no person shakes hands with any other person more than once?

(iii) Assuming that all the people assembled in the room can play cricket, how many distinct 11 member cricket teams can be formed from this group?

90. Consider a function of x containing positive integral powers of x only, arranged in descending powers of x with a constant at the end. All the coefficients of the powers of x are real numbers. If this expression is equated to zero, we have an equation. Select all correct statements below; (put a' tick' mark) one or more may be correct.

(i) If the highest power of x in this equation is 3, then this equation has 3 real roots.

(ii) If the highest power of x in this equation is 2, then this equation will have 2 roots not necessarily real.

(iii) If the highest power of x in this equation is 2, and if one of the roots is complex, then the other is the conjugate of the first root.

(iv) If one of the coefficients in the equation is complex, then statement (iii) above is not true

(v) This equation can always be solved in terms of roots and radicals to yield solutions

(vi) If all coefficients are positive, then the equation has no positive root.

91. Given that log 2 = 0.3010 and log 3 = 0.4771, solve for x: $6^x = \dfrac{10}{3} - 6^{-x}$

91. A sum of money is distributed among certain persons. The first person gets Re 1, the second person gets Re 1 more than the first, the third person gets Rs 2 more than the second, the fourth person Rs 3 more than the third, and so on till the last man gets Rs 67. How many people were there, and what was the sum distributed?

Use induction to set up a recurrence relationship, it may help.

92.     (i) How long will a sum of money take to double itself at 10% simple interest?

(ii) If interest is compounded twice a year, then how long will the money take to double itself? For this part, please note that log 2 = 0.3010, log 1.1 = 0.0414, and for small x,          log (1 + 2x) ~ 2 log (1 + x).

93.  Consider the curve y = x$^2$ – 2x + 3.

(i)     Will this curve have a maxima or minima or both? Why?

(ii)    Find this (maxima and/or minima) point using differentiation. Please **state clearly** whether the operation you have performed has resulted in a maxima or minima.

94. Find the inverse of $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

95.    Solve the ordinary differential equation : $(1 - x^2)\dfrac{dy}{dx}$ - xy = x$^2$; note the curve passes through (0,2)

96.    Gopal is a clever boy; or so he thinks! He has to appear for a class test (multiple-choice type) tomorrow. In order to pass, he has to answer **AT LEAST** 7 questions out of 10 correctly. If his strategy is to randomly guess the answer from four alternatives for each question, then what is the probability of Gopal

(i) getting every single question wrong?
(ii) getting every single question right?
(iii) passing the examination
(iv) if  instead of four, the question paper had five alternatives for every question, will the probabilities for parts (i) to (iii) go up, come down, or remain the same?

97. The UCIPR wants to plant roses in their porch. There are has 49 roses to plant – some red and some white. If it is desired to plant the roses in a square formation such that the outer periphery of roses is red in color, then how many white roses need to be purchased?

98.    If you are told that 103823 is a perfect cube, then what is the cube root of this number? You can write it down by inspection if you note that the cube of 4 is 64 and the cube of 5 is 125.

99.    Pick up the individual boxes and place them in the groups below

| G | | A | | Phe | | Cys | | G | | Leu | | His | | C | | Arg | | Pro | | T | | Ala |

| T | | U | | sugar | | P | | Ser | | A | | P | | U | | Gly | | sugar | | A | | P |
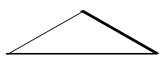
**DNA**                    **RNA**                         **Protei**

100)  Identify the correct casual factors and match them with the appropriate disaster

Casual factors                                                          Disasters

SOx, E.coli, NO2, CO, Vibrio cholera,
Staphylococcus, CO2, CH4, CFC, Cl,
O3, O2, DO, NO3, NH3, NO2, PAN,
Dioxin, salmonella, Streptococcus,
Clostridium

Global warming
Ozone depletion
Epidemics
Acid Rain