Max. Time : $3\frac{1}{2}$ hrs. Max. Marks : 200

Useful Constants

Boltzmann constant (k) = 1.38×10^{-23} J K^{-1}

Avogadro's number (N_A) = 6.02×10^{23} mol^{-1}

Planck's constant (h) = 6.63×10^{-34} J S

Speed of light in vacuum (c)

= 3×10^8 ms su – 1

Rest mass of electron (m_e)

= 9.1×10^{-31} kg

1 (unified) atomic mass unit (u)

= 1.66×10^{-27} kg

1 eV = 1.6×10^{-19} J

1 nm = 10^{-9} m

Charge of Electron (e) = 1.6×10^{-19} C

Gas constant (R) = 8.31 J mol^{-1} K^{-1}

GENERAL KNOWLEDGE

1. Birbal Sahni was a :

(1) Zoologist

(2) Founder of Central Drug Research Institute (CDRI)

(3) Omithologist.

(4) Paleobotanist.

2. In the year (2003) the chemistry Nobel Prize was awarded to the following work:

(1) Aquaporins (2) Na^{++} channels

(3) Ca^{++} channels (4) Methyl chavicol

3. It lives underwater for up to three years as 'nymph' before emerging as a flying insect. Fossils of this insect dating back about 300 million years have been found :

(1) Scorpion fly (2) Stone fly

(3) Caddis fly (4) May fly

4. A man - made tunnel in India transfers water from which one river to another?

(1) Narmada to Tapti

(2) Betwa to Stone

(3) Beas to Sutlej (4) Godavari to Krishna

5 The great Fisher Bank in situated off :

(1) The coast of New Foundland

(2) The Chilean coast

(3) The Spanish coast

(4) The coast of Great Britain

6. Which one of the following organisation's iron and steel plant was built to use charcoai as a source of power, to start with, but later switched over to hydroelectricity?

(1) The Tata Iron and Steel Company

(2) The Indian Iron and Steel Company

(3) Mysore Iron and Steel Limited.

(4) Hindustan Steel Limited.

7. Rishikesh is famous for the production of :

(1) Antibiotics (2) Heavy electricals

(3) Fertilizers (4) Transistorized radios.

8. Rayon fibre is manufactured from

(1) Petroleum (2) Wood and pulp

(3) Chemicals (4) Naphtha

9. Nepanagar is famous for :

(1) Paper board industries

(2) Craft paper industries

(3) Carbcn paper industries

(4). Newsprint paper industries.

10. Since the Britishers wanted India to produce and supply raw materials to feed English factories, they pushed a policy that encouraged cultivation of :

(1) Jute (2) Indigo

(3) Cotton (4 Commercial corp.

11. Primary sector refer to :

(1) Industry (2) Agriculture

(3) Trade (4) Banks

12. Recently there was a report on adverse effect of wearing neck tie. Tight neck tie may cause :

(1) Glaucoma (2) Hypertension
(3) Hoarseness of voice
(4) Hyperthyroidism

13. The noise produced in office is normally at the level of :

(1) 20 db (2) 30 db
(3) 40 db (4) 60 db

14. In the year 2003 in an eco-maratho contest in Hiroshima the 'Fancy Carol' recorded the mileage of distance per liter of petrol as :

(1) 396 km/litre (2) 936 km/litre
(3) 1962 km/litre (4) 3962 km/litre

15. Dravida Munnetra Kazhakam (DMK) was founded by :

(1) M.G. Ramachandran
(2) C.N. Annaduraj
(3) Kumar Swami Kamraj
(4) Lalithambika Antharjanam.

16. All of the following won the title of 'Miss World' except :

(1) Lara Dutta (2) Aishwarya Rai
(3) Yukta Mukhi (4) Priyanka Chopra.

17. Where is 'Indra Gandhi Rashtriya Uran Akadimi' situated?

(1) Dehradum (2) Raebareli
(3) Allahabad (4) Mussorrie

18. All of the following are correct about 'Media Lab' except :

(1) The third media lab is situated in India
(2) It is supported by government funding
(3) It is interdisciplinary i.e. involves sociologists economists, computer sciences etc.
(4). It plans to produce wearable computer.

19. In the year 2003 which of the following Indian American was honored by President Bush for his research in automotive technology?

(1) Hiren Gandhi (2) Sabeer Bhatia
(3) Guraj Deshpande
(4) Vinod Khosla

20. Who of the following was a medical doctor?

(1) Samuel Taylor Coleridge
(2) John Webster
(3) Somerset Maugham
(4) Thomas Gray

BIOLOGY

21. Cultivation of Bt Cotton has been much in the news. The prefix "Bt" means :

(1) "Barium -treated" cotton seeds
(2) "Bigger thread" variety of cotton with better tensile strength
(3) Produced by "biotechnology" using restriction enzymes and ligases
(4) Carrying an endotoxin gene from *Bacillus thuringensis*.

22. Which one feature is common to leech, cockroach and scorpion?

(1) Nephridia (2) Ventral nerve cord
(3) Cephalization (4) Antennae

23. Unidirectional transmission of a nerve impulse through nerve fibre is due to the fact that :

(1) Nerve fibre is insulated by a medullary sheath.
(2) Sodium pump starts operating only at the cyton and then continues into the nerve fibre.
(3) Neurotransmitters are released by dendrites and not by axon endings
(4) Neurotransmitters are released by the axon endings and not by dendrites.

24. The total number of nitrogenous bases in human genome is estimated to be about :

(1) 3.5 million (2) 3.5 thousand
(3) 35 million (4) 3.1 billion

25. The Great Barrier Reef along the east coast of Australia can be categorised as:

(1) Population (2) Community
(3) Ecosystem (4) Biome

26. Which one of the following is a pair of endangered species?

(1) Garden lizard and Mexican poppy
(2) Rhesus monkey and Sal tree
(3) Indian peacock and carrot grass
(4) Hornbill and Indian Aconite

27. Which one of the following is a matching pair of a drug and hits category?
(1) Amphetamines - Stimulant
(2) Lysergic acid Dimethyl amide - Narcotic
(3) Heroin - Psychotropic
(4) Benzodiazepines - Pain killer

28. In which one of the following pairs the two items mean one and the same thing?
(1) Malleus - anvil
(2) SA node - pacemaker
(3) Leucocytes - lymphocytes
(4) Haemophilia - blood cancer

29. Which one of the following categories of organisms do not evolve oxygen during photosynthesis?
(1) Red algae
(2) Photosynthetic bacteria
(3) C_4 plants with Kranz anatomy
(4) Blue green algae

30. A baby has been born with a small tail. It is a case exhibiting :
(1) Retrogressive evolution
(2) Mutation (3) Atavism
(4) Metamorphosis

31. Which one of the following is correctly matched regarding an Institute and its location?
(1) National Institute of Virology -Pune
(2) National Institute of Communicable Diseases - Lucknow
(3) Central Drug research Institute - Kasauli
(4) National Institute of Nutrition - Mumbai

32. Electron beam therapy is a kind of radiation therapy to treat :
(1) Enlarged prostate gland
(2) Gall bladder stones by breaking them
(3) Certain types of cancer
(4) Kidney stones

33. Severe Acute Respiratory Syndrome (SARS) :
(1) Is caused by a variant of *Pneumococcus* pneumoniae
(2) Is caused by a variant of the common cold virus (corona virus)
(3) Is an acute form of asthma
(4) Affects non- vegetarians faster than the vegetarians.

34. Cattle fed with spoilt hay of sweet clover which contains dicumarol :
(1) Are healthier due to a good diet
(2) Catch infections easily
(3) May suffer vitamin K deficiency and prolonged bleeding
(4) May suffer form Beri Beri due to deficiency of B vitamins.

35. If the Bengal Tiger becomes extinct :
(1) Hyenas and wolves will become scarce
(2) The wild areas will be safe for man and domestic animals
(3) Its gene pool will be lost for ever
(4) The populations of beautiful animals like deers will get stabilized.

36. Nitrogen oxides produced from the emission of automobiles and power plants, are the source of fine air borne particles which lead to :
(1) Photochemical smog
(2) Dry acid deposition
(3) Industrial smog (4) Wet acid deposition

37. A lake with an inflow of domestic sewage rich in organic waste may result in :
(1) Drying of the lake very soon to algal bloom
(2) An increased production of fish due to lot of nutrients
(3) Death of fish due to lack of oxygen
(4) Increased population of aquatic food web organisms.

38. Minamata disease was caused due to the consumption of :
(1) Sea food containing lot of cadmium
(2) Fish contaminated with mercury
(3) Oysters with lot of pesticide
(4) Sea food contaminated with selenium.

39. An artificial pacemaker is implanted subcutanously and connected to the heart in patients :

(1) Having 90% blockage of the three main coronary arteries
(2) Having a very high blood pressure
(3) With iregularity in the heart rhythm
(4) Suffering from arteriosclerosis.

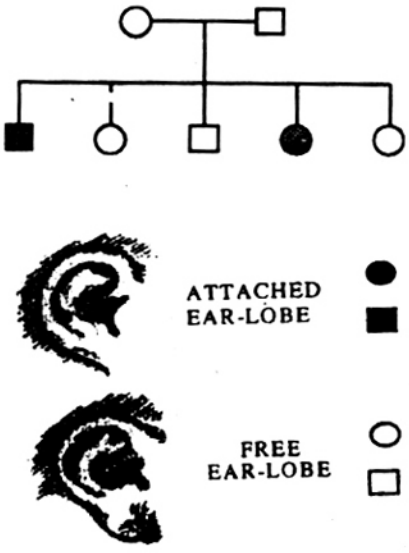
40. An example of gene therapy is :
(1) Production of injectable Hepatitis B vaccine
(2) Production of vaccines in food crops like potatoes which can be eaten
(3) Introduction of gene for adenosine deaminase in persons suffering form Severe Combined Immuno- deficiency (SCID).
(4) Production of test tube babies by artificial insemination and implantation of fertilized eggs.

41. The pollen tube usually enters the embryo sac :
(1) Through one of the synergids
(2) By directly penetrating the egg
(3) Between one synergid and central cell
(4) By knocking off the antipodal cells.

42. What is the first step in the Southern Blot technique?
(1) Denaturation of DNA on the gel for hybridization with specific probe.
(2) Production of a group of genetically identical cells.
(3) Digestion of DNA by restriction enzyme
(4) Isolation of DNA from a nucleated cell such as the one from the scene of crime.

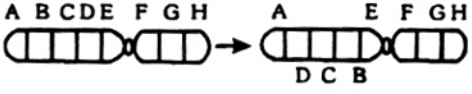
43. Women who consumed the drug thalidomide for relief from vomiting during early months of pregnancy gave birth to children with :
(1) No spleen
(2) Hare-lip
(3) Extra fingers and toes
(4) Underdeveloped limbs.

44. Given below is a pedigree chart of a family with five children. It shows the inheritance of attached ear-lobes as opposed in the free ones. The squares represent the male individuals and circles the female individuals : Which one of the following conclusions drawn is correct?



(1) The parents are homozygous recessive
(2) The trait is Y- linked
(3) The parents are homozygous dominant
(4) The parents are heterzygous.

45. Given below is the representation of a kind of chromosomal mutation : What is the kind of mutation represented?



(1) Deletion
(2) Duplication (3) Inversion
(4) Reciprocal translocation.

46. Which one of the following pairs is correctly matched with regard to the codon and the amino acid coded by it?
(1) UUA – Valine (2) AAA – Lysine
(3) AUG – Cysteine (d) CCG – Alanine.

47. The treatment of snake-bite by antivenom is an example of :
(1) Artificially acquired active immunity
(2) Artificially acquired passive immunity
(3) Naturally acquired passive immunity
(4) Specific natural immunity.

48. The bacteria *Pseudomonas* is useful because of its ability to :
(1) Transfer genes from one plant to another

(2) Decompose a variety of organic compounds
(3) Fix atmospheric nitrogen in the soil
(4) Produce a wide variety of antibiotics.

49. DNA is present in :
(1) Chromosomes and dictyosomes
(2) Chloroplasts and lysosomes
(3) Mitochondria and chloroplasts
(4) Mitochondria and endoplasmic reticulum.

50. Pruning of plants promotes branching because the axillary buds get sensitized to :
(1) Ethylene (2) Gibberellin
(3) Cytokinin (4) Indole acetic acid

51. The sugarcane plant has :
(1) Dumb -bell shaped guard cells.
(2) Pentamerous flowers
(3) Reticulate venation
(4) Capsular fruits

52. Potato and sweet potato
(1) Have edible parts which are homologous organs
(2) Have edible parts which are analogous organs
(3) Have been introduced in India from the same place
(4) Are two species of the same genus.

53. In *Ulothrix* meiosis takes place in :
(1) Cells of the filament
(2) Holdfast
(3) Zygote
(4) Zoospores

54. In a plant organ which is covered by periderm and in which the stomata are absent, some gaseous exchange still takes place through :
(1) Aerenchyma (2) Trichomes
(3) Pneumatophores (4) Lenticels

55. Somaclonal variation can be obtained by :
(1) Application of colchicine
(2) Irradiation with gamma rays
(3) Tissue culture
(4) Hybridization

56. In the high altitude birds become rare or extinct, the plants which may disappear along with them are :
(1) Pine (2) Oak
(3) Orchids (4) Rhododendrons

57. Companion cells in plants are associated with :
(1) Vessels (2) Sperms
(3) Sieve elements (4) Guard cells

58. Mosses and ferns are found in moist and shady places because both :
(1) Require presence of water for fertilization
(2) Do not need sunlight for photosynthesis
(3) Depend for their nutrition on microorganisms which can survive only at low temperature.
(4) Cannot compare with sun– loving plants.

59. Cork cambium results in the formation of cork which becomes impermeable to water due to the accumulation of :
(1) Resins (2) Suberin
(3) Lignins (4) Tannins

60. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross :
AA BB CC x aa bb cc
(1) 3 (2) 8 (3) 27 (4) 64

CHEMISTRY

61. Which of the following is only acidic in nature?
(1) $Be(OH)_2$ (2) $Mg(OH)_2$
(3) $B(OH)_3$ (4) $Al(OH)_3$

62. Which one of the following froms with an excess of CN^- (Cyanide) a complex having coordination number two?
(1) Cu^+ (2) Ag^+ (3) ni^{2+} 4) Fe^{2+}

63. Which of the following is not considered as an organometallic compound?
(1) Cis -platin (2) Ferrocene
(3) Zeise's salt (4) Grignard reagent

64. Dimethyl glyoxime gives a red precipitate with Ni^{2+}, which is used for its detection. To get this precipitate readily the best pH range is :

(1) <1 (2) 2-3 (3) 3-4 (4) 9-11

65. The element which forms oxides in all oxidation states +I to +V is :

(1) N (2) p (3) As (4) Sb

66. For decolourization of 1 mole of $KMnO_4$, the moles of H_2O_2 required is :

(1) 1/2 (2) 3/2 (3) 5/2 (4) 7/2

67. The statements true for N_3^- is :

(1) It has a non- linear structure

(2) It is called pseudohalogen

(3) The formal oxidation state of nitrogen in this anion is –1

(4) It is isoelectronic with NO_2

68. Which of the following does not have optical isomer?

(1) $[Co(NH_3)_3 Cl_3]$ (2) $[Co(en)_3] Cl_3$

(3) $[Co(en)_2 Cl_2] Cl$

(4) $[Co (en) (NH_3)_2 Cl_2] Cl$

69. For electron affinity of halogens which of the following is correct :

(1) Br>F (2) F>Cl

(3) Br>Cl (4) F>I

70. Shape of O_2F_2 is similar to that of :

(1) C_2F_2 (2) H_2O_2 (3) H_2F_2 (4) C_2H_2

71. The liquid fied metal expanding on solidification is :

(1) Ga (2) Al (3) Zn (4) Cu

72. The compound insoluble in water is :

(1) Mercurous nitrate

(2) Mercuric nitrate (3) Mercurous chloride

(4) Mercurous perchlorate

73. Which of the following imparts green colour to the burner flame?

(1) $B(OMe)_3$ (2) Na(OMe)

(3) $Al(OPr)_3$ (4) $Sn(OH)_2$

74. The ONO angle is maximum in :

(1) NO_3^- (2) NO_2^-

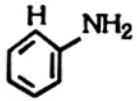
(3) NO_2 (4) NO_2^+

75. Among the following the dissociation constant is highest for :

(1) C_6H_5OH (2) $C_6H_5CH_2OH$

(3) $CH_3C \equiv CH$ (4) $CH_3NH_3^+Cl^-$

76. The strongest base among the following is?

1. 
2. 
3. 
4. 

77. The compound having only primary hydrogen atom is :

(1) Isobutene (2) 2,3 -Dimetyl butene

(3) Cyclohexane (4) Propyne

78. Among the following the aromatic compound is :

1. 
2. 
3. 
4. 

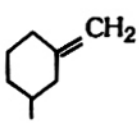
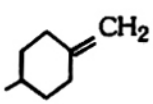
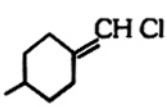
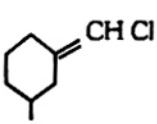
79. The dilpole moment is the highest for :

(1) *Trans* -2- butene

(2) 1,3 - Dimethyl benzene

(3) Acetophenone (4) Ethanol

80. The geometrical isomerism is shown by :

1. 
2. 
3. 
4. 

81. The reagent used for the separation of acetaldehyde from acetophenone is :

(1) $NaHSO_3$ (2) $C_6H_5NHNH_2$

(3) NH_2OH (4) NaOH – I_2

82. Among the following the most reactive towards alcoholic KOH is

(1) $CH_2 = CHBr$ (2) $CH_3COCH_2\ CH_2Br$

(3) CH_3CH_2Br (4) $CH_3CH_2CH_2Br$

83. Among the following, the one which reacts most readily with ethanol is :

(1) p- nitrobenzyl bromide

(2) p- chlorobenzyl bromide

(3) p- methoxybenzyl bromide

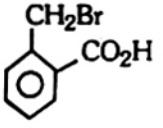
(4) p- methylbenzyl bromide

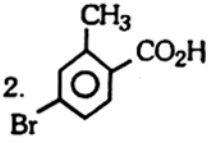
84. The nucleic acid base having two possible binding sites is :

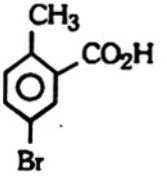
(1) Thymine (2) Cytosine

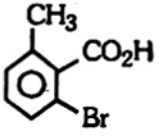
(3) Guanine (4) Adenine

85. o-Toluic acid on reaction with Br_2 + Fe gives :

1. 

2. 

3. 

4. 

86. Aromatic nitriles (ArCN) are not prepared by reaction :

(1) ArX + KCN

(2) Ar N_2^+ + CuCN

(3) Ar $CONH_2 + P_2O_5$

(4) Ar $CONH_2 + SOCl_2$

87. Melting points are normally the highest for :

(1) Tertiary amides (2) Secondary amides

(3) Primary amides (4) Amines

88. The most suitable reagent for the conversion of $RCH_2OH \longrightarrow RCHO$ is :

(1) $KMnO_4$

(2) $K_2Cr_2O_2$ 3) CrO_3

(4) PCC (Pyridine chloro chromate).

89. Which of the following is arranged in the increasing order of enthalpy of vaporization?

(1) NH_3 , PH_3 , AsH_3

(2) AsH_3 , PH_3 , NH_3

(3) NH_3 , AsH_3 , PH_3

(4) PH_3 , AsH_3 , NH_3

90. For principle quantum number n=4 the total number of orbitals having 1 : 3 is :

(1) 3 (2) 7 (3) 5 (4) 9

91. The average osmotic pressure of human blood is 7.8 bar at 37° C. What is the concentration of an aqueous NaCl solution that could be used in the blood stream?

(1) 0.16 mol/L (2) 0.32 mol/L

(3) 0.60 mol/L (4) 0.45 mol/L

92. How much energy is released when 6 mole of octane is burnt in air? Given ΔH_f° for CO_2 (g) , H_2O (g) and C_8H_{18}(l) respectively are
– 490 – 240 and + 160 J/mol.

(1) – 6.2 k J (2) – 37.4 k J

(3) – 35.5 k J (4) – 20.0 k J

93. For the equilibrium $H_2O\ l - H_2O$(g) at 1 atm and 298 K.

(1) standard free energy change is equal to zero ($\Delta G^\circ = 0$)

(2) Free energy change is less than zero ($\Delta G < 0$)

(3) Standard free energy change is less than zero ($\Delta G^\circ < 0$)

(4) Standard free energy change is greater than zero ($\Delta G^\circ > 0$)

94. The crystal system of a compound with unit cell dimensions
a = 0.387 , b = 0.387 and c = 0.504 nm and $\alpha = \beta = 90°$ and $\gamma = 120°$ is :

(1) Cubic (2) Hexagonal

(3) Orthorhombic (4) Rhombohedral

95. What is the pH of 0.01 M glycine solution? For glycine,

$Ka_1 = 4.5 \times 10^{-3}$ and $Ka_2 = 1.7 \times 10^{10}$ a t 298 K :

(1) 3.0 (2) 10.0 (3) 6.1 (4) 7.2

96. Of the following which change will shift the reaction forwards the product?

$I_2 \rightleftharpoons 2I(g)$, ΔH°, (298 K) = + 150 kJ

(1) Increase in concentration of I

(2) Decrease in concentration of I_2

(3) Increase in temperature

(4) Increase in total pressure.

97. Which of the following statements in TRUE for the electrochemical Daniel cell :

(1) Electrons flow from copper electrode to zinc electrode

(2) Current flows from zinc electrode to copper electrode

(3) Cations move towards copper electrode

(4) Cations move toward zinc electrode.

98. Which of the following is a biodegradable polymer?

(1) Cellulose (2) polytene

(3) Polyvanyl chloride (4) Nylon -6

99. The rate constant, k, for the reaction $N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ is $2.3 \times 10^{-2}\ s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time? $[N_2O_5]_o$ and $[N_2O_5]_1$ correspond to concentration of N_2O_5 initially and at time, t :

(1) $[N_2O_5]_t = [N_2O_5]_o + kt$

(2) $[N_2O_5]_o = [N_2O_5]_t e^{kt}$

(3) $\log_{10}[N_2O_5]_t = \log_{10}[N_2O_5]_o - kt$

(4) $\ln \frac{[N_2O_5]_o}{[N_2O_5]_t} = kt$

100. Ozone in stratosphere is depleted by

(1) CF_2Cl_2 (2) C_7F_{16}

(3) $C_6H_6Cl_6$ (4) C_6F_6

PHYSICS

101. The waves produced by a motorboat sailing in water are :

(1) Transverse (2) Longitudinal

(3) Longitudinal and transverse

(4) Stationary

102. In an orbital motion, the angular momentum vector is :

(1) Along the radius vector

(2) Parallel to the linear momentum

(3) In the orbital plane

(4) Perpendicular to the orbital plane.

103. A nucleus of mass number A, originally at rest, emits an α - particles with speed v. The daughter nucleus recoils with a speed :

(1) $2v/(A+4)$ (2) $4v/(A+4)$

(3) $4v/(A-4)$ (4) $2v/(A-4)$

104. When an electron positron pair annihilates, the energy released is about :

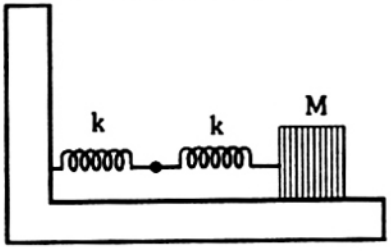
(1) 0.8×10^{-13} J (2) 1.6×10^{-13} J

(3) 3.2×10^{-13} J (4) 4.8×10^{-13} J

105. A sphere of mass M and radius R is falling in a viscous fluid. The terminal velocity attained by the falling object will be proportional to :

(1) R^2 (2) R (3) $1/R$ 4) $1/R^2$

106. Two springs are connected to a block of mass M placed on a frictionless surface as shown below. If both the springs have a spring constant k, the frequency of oscillation of the block is :



(1) $(1/2\pi)\sqrt{(k/M)}$ (2) $(1/2\pi)\sqrt{\left(\frac{k}{2M}\right)}$

(3) $(1/2\pi)\sqrt{(2k/M)}$ (4) $(1/2\pi)\sqrt{(M/k)}$

107. A proton of energy 4 eV is incident on a metal surface whose work function is 2 eV. The minimum reverse potential to be applied for stopping the emission of electrons is :

(1) 2V (2) 4 V (3) 6V (4) 8V

108. A photon and an α – particle, moving with the same velocity, enter into a uniform magnetic field, acting normal to the plane of their motion. The ratio of the radii of the circular paths described by the proton and α – particle is :

(1) 1 : 2 (2) 1 : 4 (3) 1 : 16 (4) 4 : 1

109. Two parallel beams of positrons moving in the same direction will :

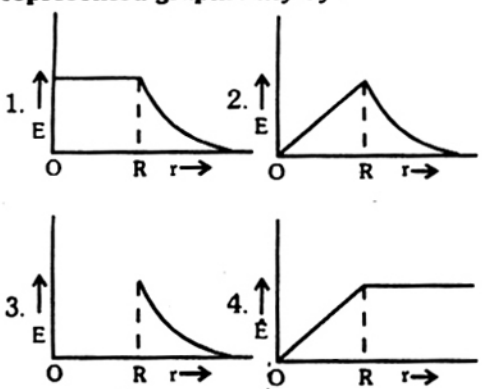
(1) Repel each other

(2) Will not interact with each other

(3) Attract each other

(4) Be deflected normal to the plane containing the two beams.

110. The electric field due to a uniformly charged sphere of radius R as a functions of the distance from its center is represented graphically by :



111. Equipotential surface associated with an electric field which is increasing in magnitude along the x--direction are :

(1) Planes parallel to yz - plane

(2) Planes parallel to xy plane

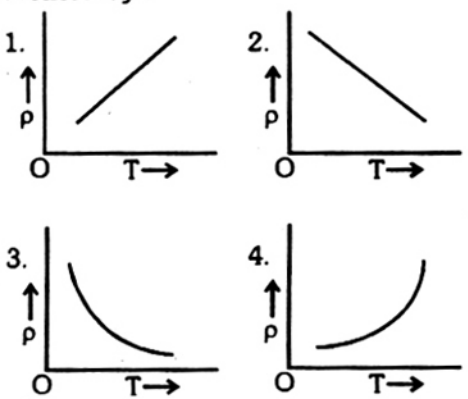
(3) Planes parallel to xz-plane

(4) Coaxial cylinders of increasing radii around the x-axis.

112. Suppose the sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emitted by it then will increase by a factor of :

(1) 10^4 (2) 625 (3) 256 (4) 16

113. The temperature (T) dependence of resistivity (ρ) of a semiconductor is represented by :



114. In old age arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from :

(1) Pascal's law (2) Stokes' law

(3) Bernoulli's principle

(4) Archimedes principle

115. A circular coil of radius R carries an electric current. The magnetic field due the coil at a point on the axis of the coil located at a distance r from the centre of the coil, such that r >>R, varies as :

(1) $1/r$ (2) $1/r^{3/2}$ (3) $1/r^2$ (4) $1/r^3$

116. The direction of the angular velocity vector is along :

(1) The tangent to the circular path.

(2) The inward radius

(3) The outward radius

(4) The axis of rotation

117. Sodium lamps are used in foggy conditions because :

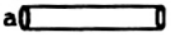
(1) Yellow light is scattered less by the fog particles

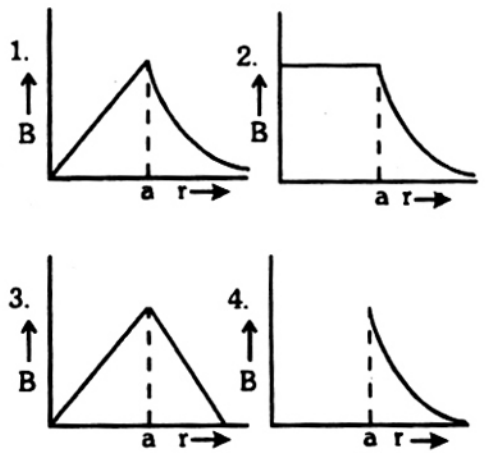
(2) Yellow light is scattered more by the fog particles

(3) Yellow light is unaffected during its passage through the fog.

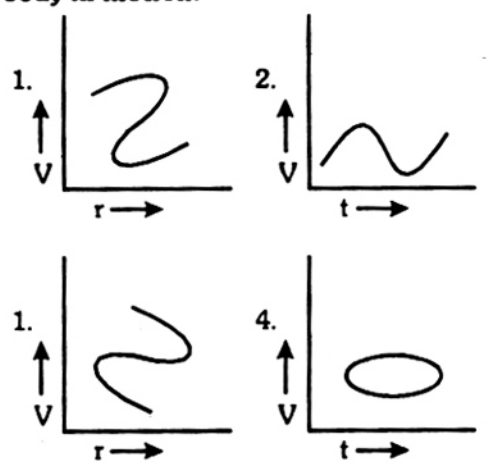
(4) Wavelength of yellow light is the mean of the visible part of the spectrum.

118. The magnetic field due to a straight conductor of uniform cross section of radius a and carrying a steady current is represented by :





119. Which of the following velocity-time graphs shows a realistic situation for a body in motion?



120. A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is :

(1) 1.07 kJ (2) 2.14 kJ
(3) 2.4 kJ (4) 4.8 kJ

121. A monochromatic beam of light is used for the formation of fringes on the screen by illuminating the two slits in the Young's double slit interference experiment. When a thin film of mica is interposed in the path of one of the interfering beams then :

(1) The fringe width increases
(2) The fringe width decreases
(3) The fringe width remains the same but the pattern shifts.
(4) The fringe pattern disappears.

122. An object is immersed in a fluid. In order that the object becomes invisible, it should

(1) Behave as a perfect reflector
(2) Absorb all light falling on its
(3) Have refractive index one
(4) Have refractive index exactly matching with that of the surrounding fluid.

123. An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is :

(1) 14 (2) 13 (3) 6 (4) 9

124. The Magnetic Resonance Imaging (MRI) is based on the phenomenon of :

(1) Nuclear magnetic resonance
(2) Electron spin resonance
(3) Electron paramagnetic resonance
(4) Diamagnetism of human tissues.

125. Carbon dating is best suited for determining the age of fossils if their age in years is of the order of :

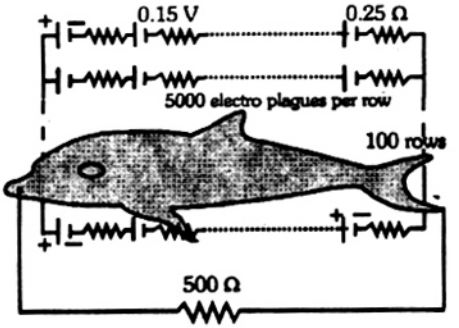
(1) 10^3 (2) 10^4 (3) 10^5 (4) 10^6

126. A 40 μ F capacitor in a defibrillator is charged to 3000 V. The energy stored in the capacitor is sent through the patient during a pulse of duration 2 ms. The power delivered to the patient is :

(1) 45 kW (2) 90 kW
(3) 180 kW (4) 360 kW

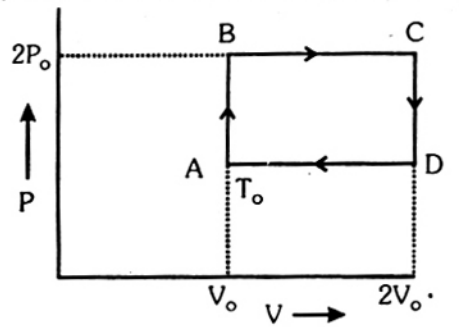
127. Eels are able to generate current with biological cells called electroplaques. the electroplaques in an eel are arranged in 100 rows, each row stretching horizontally along the body of the fish containing 5000 electroplaques. The e

rangement is suggestively shown below. Each electroplaques has an emf of 0.15 V and internal resistance of 0.25 Ω . The water surrounding the eel completes circuit between the head and its tail. If the water surrounding it has a resistance of 500 Ω, the current an eel can produce in water is about :



(1) 1.5 A (2) 3.0 A (3) 15 A (4) 30 A

128. N moles of a monoatomic gas is carried round the reversible rectangular cycle ABCDA as shown in the diagram. The temperature as A is T_o . The thermodynamic efficiency of the cycle is :



(1) 15% (2) 50% (3) 20% (4) 25%

129. Liquid oxygen remains suspended between two pole faces of a magnet because it is :

(1) Diamagnetic (2) Paramagnetic
(3) Ferromagnetic (4) Antiferromagnetic

130. An endoscope is employed by a physician to view the internal parts of a body organ. It is based on the principle of :

(1) Refraction (2) Reflection
(3) Total internal reflection (4) Dispersion.

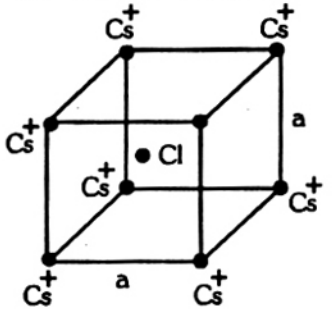
131. We wish to see inside an atom, Assuming the atom to have a diameter of 100 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about :

(1) 1.5 keV (2) 15 keV
(3) 150 kev (4) 1. 5 MeV

132. When a compact disc is illuminated by a source of while light, coloured 'lones' are observed. This is due to :

(1) Dispersion (2) Diffraction
(3) Interference (4) Refraction

133. In the basic Cs Cl crystal structure, Cs^+ and Cl^- ions are arranged in a bcc configuration as shown below. The net electrostatic force exerted by the eight Cs^+ ions on the Cl^- ion is :



(1) $\frac{1}{4\pi\epsilon_o}\frac{4e^2}{3a^2}$ (2) $\frac{1}{4\pi\epsilon_0}\frac{16e^2}{3a^2}$

(3) $\frac{1}{4\pi\epsilon_0}\frac{32e^2}{3a^2}$ (4) Zero.

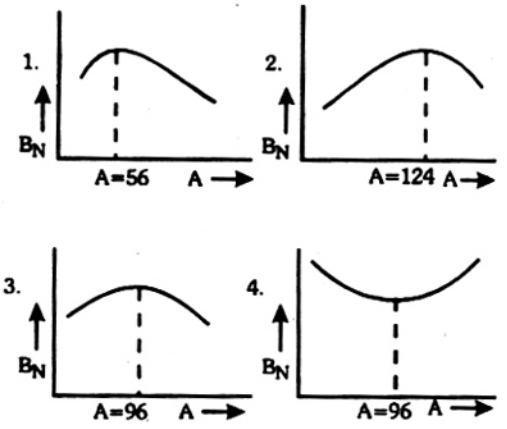
134. The magnetic moment of a current (I) carrying circular coil of radius (r) and number of turns (n) varies as

(1) $1/r^2$ (2) $1/r$ (3) r (4) r^2

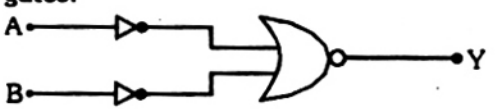
135. The cyclotron frequency of an electron gyrating in a magnetic field of 1T is approximately :

(1) 28 MHz (2) 280 MHz
(3) 2.8 GHz (4) 28 GHz

136. The dependence of binding energy per nucleon, B_N on the mass number. A, is represented by :



137. Which logic gate is represented by the following combination of logic gates?



(1) Or (2) NAND (3) AND (4) NOR

138. A Ge specimen is doped with Al. The concentration of acceptor atoms $1\sim 10^{21}$ atoms/m^3. Given that the intrinsic concentration of electron -hole pairs is DD~ $10^{19}/m^3$, the concentration of electrons in the specimen is :

(1) $10^{17}/m^3$ (2) $10^{15}/m^3$

(3) $10^{4}/m^3$ (4) $10^{2}/m^3$

139. V_{rms}, V_{am} and V_{mp} are root mean square, average and most probable speeds of molecules of a gas obeying Maxwellian velocity distribution. Which of the following statements is correct :

(1) $V_{rms} < V_{av} < V_{mp}$

(2) $V_{rms} > V_{av} > V_{mp}$

(3) $V_{mp} > V_{rms} > V_{av}$

(4) $V_{mp} > V_{rms} > V_{av}$

140. Using mass (M), length (L), time (T) and current (A) as fundamental quantities, the dimension of permitivity is :

(1) $ML^{-2}T^2A$ (2) $M^{-1}L^{-3}T^4A^2$

(3) MLT^2A (4) $ML^2T^1A^2$

Asserstion and Reasoning

§ ***the following question (141-200), statement of assertion (1) is followed by a statement of reason (R)***

If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark 1.

If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark 2

If Assertion is true statement but reason is false, then mark 3

If both Assertion & Reason are false statements, then mark 4

BIOLOGY

141 A. Agricultural output increased several times after introduction of DDT.

R. DDT was the first insecticide used on a wide scale

142 A. Diabetes insipidus is marked by excessive urination and too much thirst for water.

R. Anti- diuretic hormone (ADH) is secreted by the posterior lobe of pituitary gland.

143 A. Coacervates are believed to be the precursors to life.

R. Coacervates were self -duplicating aggregates of proteins surrounded by lipid molecules.

144 A. Tapeworm, roundworm and pinworm are endoparasites of human intestine.

R. Improperly cooked food is the source of all intestinal infections.

145 **A.** Fish meal is a rich source of protein for cattle and poultry.

R. Fish meal is produced from non-edible parts of fishes like fins, tail etc.

146 **A.** Animals adopt different strategies to survive in hostile environment.

R. Praying mantis is green in colour which merges with plant foliage.

147. **A.** Among the primates, chimpanzee is the closest relative of the present day humans.

R. The banding pattern in the autosome numbers 3 and 6 of man and chimpanzee is remarkably similar.

148 **A.** Dope test is used to estimate the level of blood alcohol by analyzing the breath of persons drinking alcohol.

R. A drunken person usually feels tense and is less talkative.

149 **A.** The honey bee queen copulates only once in her life time.

R. The honey bee queen can lay fertilized as well as unfertilized eggs.

150 **A.** From evolutionary point of view, human gestation period is believed to be shortening

R. One major evolutionary trend in humans has been the larger head undergoing relatively faster growth rate in the foetal stage.

151 **A.** Natural selection is the outcome of differences in survival and reproduction among individuals that show variation in one or more traits.

R. Adaptive forms of a given trait tend to become more common; less adaptive ones become less common or disappear.

152 **A.** Ginger has a postrate- growing rhizome.

R. Shoot growth is not effected by gravity.

153 **A.** Photomodulation of flowering is a phytochrome - regulated process.

R. Active form of phytochrome (Pfr) directly induces floral induction in shoot buds.

154 **A.** Cyclic pathway of photosynthesis first appeared in some eubacterial species.

R. Oxygen started accumulating in the atmosphere after the non -cyclic pathway of photosynthesis evolved.

155 **A.** Nitrogen fixing bacteria in legume root nodules survive in oxygen - depleted cells of nodules.

R. Leghemoglobin completely removes oxygen from the nodule cells.

156 **A.** Red algae contribute in producing coral reefs.

R. Some red algae secreted and deposit calcium carbonate over their walls.

157. **A.** Insects visit flowers to gather honey.

R. Attraction to flowers prevents the insects from damaging other parts of the plant.

158 **A.** Coconut tree is distributed in coastal areas over a large part of the world.

R. Coconut fruit can float and get dispersed over thousands of kilometers before losing viability.

159 **A.** Deficiency of sulphur causes chlorosis in plants.

R. Sulphur is a constituent of chlorophyll proteins and nucleic acids.

160 **A.** Cattle breeds can be improved by superovulation and embryo transplantation.

R. Superovulation in high milk -yielding cows is induced by hormonal injection.

161 **A.** $HClO_4$ is a stronger acid than $HClO_3$.
R. Oxidation state of Cl in $HClO_4$ is + VII and in $HClO_3$ + V.

162 **A.** The free gaseous Cr atom has six unpaired electrons.
R. Half filled 's' orbital has greater stability.

163 **A.** The $[Ni(en)_3]\ Cl_2$ (en=ethylene diamine) has lower stability than $[Ni(NH_3)_6]\ Cl_2$.
R. In $[Ni(en)_3]\ Cl_2$ geometry of Ni is trigonal bipyramidal.

164 **A.** Sb (III) is not precipitated as sulphide when in its alkaline solution H_2S is passed.
R. The concentration of S^{2-} ion in alkaline medium is inadequate for precipitation.

165 **A.** Nuclear binding energy per nucleon is in the order $^{9}_{4}Be > {}^{7}_{3}Li > {}^{4}_{2}He$
R. Binding energy per nuclear increases linearly with difference in number of neutrons and protons.

166 **A.** Mg is not present in enamel of human teeth.
R. Mg is an essential element for biological functions of human .

167 **A.** Carboxypeptidase is an exopepcidase.
R. It cleaves the N -terminal bond.

168 **A.** Sucrose is an non- reducing sugar.
R. It has glyscosidic linkage.

169 **A.** Isobutanal does not give iodoform test.
R. It does not have α – hydrogen.

170 **A.** Styrene in reaction with HBr gives 2-bromo-2- phenyl-ethane.
R. Benzyl radical is more stable than alkyl radical.

171 **A.** The pka of acetic acid is lower than that of phenol.
R. Phenoxide ion is more resonance stabilized.

172 **A.** 2- Bromobutane on reaction with sodium ethoxide in ethanol gives 1-butene as a major product.
R. 1- Butene is more stable than 2-butene.

173 **A.** The major products formed by heating $C_6H_5CH_2OCH_3$ with HI are $C_6H_5\ CH_2I$ and CH_3OH
R. Benzyl cation is more stable than methyl cation.

174 **A.** Molar entropy of vaporization of water is different from ethanol.
R. Water is more polar than ethanol.

175 **A.** Aqueous gold colloidal solution is red in colour.
R. The colour arises due to scattering of light by colloidal gold particles.

176 **A.** Copper metal gets readily corroded in an acidic aqueous solution.
R. Free energy change for this process is positive.

177 **A.** Addition of silver ions to a mixture of aqueous sodium chloride and sodium bromide solution will first precipitate AgBr rather than AgCl.
R. Ksp of AgCl < Ksp of AgBr.

178 **A.** Alcohols are dehydrated to hydrocarbons in the presence of acidic zeolites.
R. Zeolites are porous catalysts.

179. A. All F -S-F angle in SF_4 greater than 90° but less than 180°

R. The lone pair-bond pair repulsion is weaker than bond pair–bond pair repulsion.

180. A. Effusion rate of oxygen is smaller than nitrogen.

R. Molecular size of nitrogen is smaller than oxygen.

PHYSICS

181. A. A larger dry cell has higher emf.

R. The emf of a dry cell is proportional to its size.

182. A. A red object appears dark in the yellow light

R. The red colour is scattered less.

183. A. In a pressure cooker the water is brought to boil. The cooker is then removed from the stove. Now on removing the lid of the pressure cooker, the water starts boiling again.

R. The impurities in water bring down its boiling point.

184. A. The true geographic north direction is found by using a compass needle.

R. The magnetic meridian of the earth is along the axis of rotation of the earth.

185. A. There are very small sporadic changes in the period of rotation of the earth.

R. Shifting of large air masses in the earth's atmosphere produce a change in the moment of inertia of the earth causing its period of rotation to change.

186. A. In a transistor the base is made thin.

R. A thin base makes the transistor stable.

187. A. ^{90}Sr from the radioactive fall-out from a nuclear bomb ends up in the bones of human beings through the milk consumed by them. It causes impairment of the production of red blood cells.

R. The energetic β –particles emitted in the decay of ^{90}Sr damage the bone marrow.

188. A. At the first glance, the top surface of the Morpho butterfly's wing appears a beautiful blue- green. If the wing moves, the colour changes.

R. Different pigments in the wing reflect light at different angles.

189. A. A famous painting was painted by not using brush strokes in the usual manner, but rather a myriad of small colour dots. In this painting the colour you see at any given place on the painting changes as you move away.

R. The angular separation of adjacent dots changes with the distance from the painting.

190. A. A disc-shaped magnet is levitated above a super conducting material that has been cooled by liquid nitrogen.

R. Superconductors repel a magnet.

191. A. Energy is released in nuclear fission.

R. Total binding energy of the fission fragments is larger than the total binding energy of the parent nucleus.

192 **A.** Smaller drops of liquid resist deforming forces better than the larger drops.

R. Excess pressure inside drop is directly proportional to its surface area.

193 **A.** The melting point of ice decreases with increase or pressure.

R. Ice contracts on melting.

194 **A.** Heavy water is preferred over ordinary water as a moderator in reactors.

R. Heavy, water, used for slowing down the neutrons, has lesser absorption probability of neutrons than ordinary water.

195 **A.** The driver in a vehicle moving with a constant speed on a straight road is in a non inertial frame of reference.

R. A reference frame in which Newton's laws of motion are applicable is non inertial.

196 **A.** In He - Ne laser, population inversion takes place between energy levels of Neon atoms.

R. Helium atoms have a meta–stable energy level.

197. **A.** A transistor amplifier in common emitter configuration has a low input impedance.

R. The base to emitter region is forward biased.

198 **A.** Thermodynamic processes in nature are irreversible.

R. Dissipative effects can not be eliminated.

199 **A.** Crystalline solids can cause X- rays to diffract.

R. Interatomic distance is crystalline solids is of the order of 0.1 nm.

200 **A.** Photoelectric effect demonstrates the wave nature of light.

R. The number of photo electron is proportional to the frequency of light.

ANSWERS WITH EXPLANATIONS

G. K.

1.(4) 2.(1) 3.(4) 4.(3) 5.(1) 6.(3) 7.(1) 8.(2) 9.(4) 10.(2) 11.(2) 12.(1) 13.(3) 15.(2) 16.(1) 17.(2) 18.(3) 19.(1) 20.(2)

BIOLOGY

21. Ans. (4) The prefix "Bt" in Bt-cotton means *Bacillus thuringensis*. Bt-cotton is a genetically modified cotton plant which carries *cry* gene from *Bacillus thuringensis* bacteria. The *cry* gene of *B thuringensis* produces a protein which forms crystalline inclusions in the bacterial spores. These crystal proteins are responsible for the insecticidal activities of the bacterial strains.

    Since *cry* gene is present in the plant itself, it produces cry proteins. When these proteins are ingested by insects, along with the parts of plant, they are dissolved in the alkaline juices present in the midgut lumen. The gut proteases process them hydrolytically to release the core toxic fragments. As a result the brush border membranes develop pores which causes their swelling and eventual lysis due to the influx of ions and water into the epithelial cells. The insects or caterpillars which consume the plant dies. Thus an effective way of controlling the pest.

22. Ans (2) Ventral nerve cord is present in leech, cockroach and scorpion. Nephridia is the excretory organ of leech. In cockroach and scorpion the excretory organ is malphigian tubules.

23. Ans. (4) Unidirectional transmission of a nerve impulse through nerve fibre is due to the fact that neurotransmitters are released by the axon endings. When an impulse reaches the end of an axon, it causes the release of chemical neurotransmitter molecules at most

synapse. These molecules diffuse across the synaptic cleft, bind to receptor proteins in the postsynaptic membrane and induces changes in the postsynaptic cell. Excitatory neurotransmitters open chemically gated channels that allow Na^+ and K^+ to diffuse through them, depolarising the postsynaptic cell.

24. Ans. (4) The human genome is 3 billion base pairs long and contains 50-100 000 genes arranged on 23 chromosomes. The genes account for 25 % of the DNA. The rest is extragenic DNA.

25. Ans (4) The Great Barrier Reef along the east coast of Australia can be categorized as Biome. Biome is a broad, regional type of ecosystem characterized by distinctive climate and soil conditions and a distinctive kind of biological community adapted to those conditions.

26. Ans (4) Hornbill and Indian Aconite is a pair of endangered species.

27. Ans. (1) Amphetamines are stimulant. It stimulates nervous system, makes a person more wakeful, increase alertness and activity, produce excitement. LSD is hallucinogen, heroin is narcotic and benzodiazepine is a depressant.

28. Ans. (2) The sinoatrial (SA) node in mammals and birds, is the site where each heartbeat originates. It is a vestige of the sinus venosus of the fish heart. SA serves as the pacemaker, the site of origin of the heartbeat.

29. Ans. (2) In photosynthetic bacteria the abrorption of a photon of light by the photosynthetic unit results in the transmission of an energetic electron from the pigment *P* to ferredoxin. The electron then leaves ferredoxin, passing along an electron transport chain and eventually combining with a proton to form a hydrogen atom. In the sulfur bacteria, the proton in extracted from hydrogen sulfide, leaving elemental sulphur as a by-product.

30. Ans. (3) Atavism is a phenomenon in which some of the ancestral characters are expressed all of a sudden. Presence of tail, body hairs all over the body, etc. are some of the characters which our ancestors had. During the course of evolution these characters were masked and new ones are expressed.

31. Ans (1) National Institute of Virology is situated in Pune.

32. Ans (3) Electron beam therapy is a kind of radiation therapy to treat certain types of cancer. In this radiation therapy, the cancerous cells are exposed to radiation to kill the cells and prevent growth of the tumour.

33. Ans. (2). Severe acute respiratory syndrome (SARS) is a viral respiratory illness caused by a coronavirus, called SARS-associated coronavirus (SARS– CoV). It was first reported in Asia in February 2003. During the SARS outbreak of February-July 2003, a total of 8,437 people worldwide became sick with SARS; of these, 813 died. Symptoms of SARS are high fever (above 38° C) and cough or breathing difficulty. SARS seems to spread by close person-to-person contact. It is most readily transmitted by respiratory droplets when an infected person coughs or sneezes

34. Ans (3) Cattle fed with spoilt hay of sweet clover which contains dicumarol may suffer vitamin k deficiency and prolonged bleeding.

35. Ans. (3) Tigers play an important role in an ecosystem. If the population of tigers are less or if it becomes extinct, there will be an ecological imbalance. The numbers of herbivores will increase so much and consequently they will die due to the scarcity of food. Soil erosion, enundation, flood and destruction of habitats are some of the consequences if tigers are removed or if it becomes extinct from the ecosystem. And the gene pool will be lost forever.

36. Ans. (1) Nitrogen oxides are highly reactive gases formed when nitrogen in fuel or combustion air is heated to temperatures above 650° C (1200° F) in the presence of oxygen. The initial product, nitric oxide (NO), oxidizes further in the atmosphere to nitrogen dioxide (NO_2), a reddish brown gas that gives photo-

chemical smog its distinctive colour. Nitrogen oxides combine with water to make nitric acid (NHO_3), which is also a major component of atmospheric acidification.

37. Ans (3) The addition of certain organic materials, such as sewage paper pulp , or food - processing wastes, to water stimulates oxygen consumption by decomposers. The impact of these materials on water quality can be expressed in terms of biological oxygen demand (BOD): a standard test of the amount of dissolved oxygen consumed by aquatic microorganisms over a five day, period. Oxygen levels begin to fall as decomposers metabolize waste material. Death of fish will occur due to lack of oxygen. Rough fish such as carp bullheads, and gar, are able to survive in this oxygen poor environment where they eat both decomposed organisms and the waste itself. Due to the large influx of organic waste, the growth of algae and aquatic plant increase in lake. And also the deposition of silt organic sediments caused by cultural eutrophication can accelerate the "aging" of the water body.

38. Ans. (2) Many metals such as mercury, lead, cadmium, and nickel are highly toxic. Levels in the parts per million range can be fatal. Minamata disease was caused due to mercury poisoning in Japan in the 1950s. Many birth defects and permanent brain damaged children were born by mothers who consumed mercury contaminated seafood while pregnant.

39. Ans. (3) Artificial pacemaker is used in patients with irregularity of the heart beat. It transmit repetitive electrical impulse to the heart in such a manner that the heart rate is maintained at a suitable level.

40. Ans. (3) Gene therapy is the introduction of a normal functional gene into cells that contain the defective *allele* of the gene. Severe combined Immuno deficiency (SCID) are more common in males than female infants. This is because 50% of SCID cases are caused by gene on the X-chromosome. The remaining cases of SCID are due to recessive genes on other chromosome; of these, half have a genetic deficiency of adenosine deaminase (ADA) or purine nucleoside phosphorylase (PNP). Deficiency of these purine degradation enzymes results in the accumulation of metabolites that are toxic to lymphoid stem cells namely dATP and dGTP. These metabolites inhibit the enzyme ribonucleotide reductase which is required for DNA synthesis; and therefore for cell replication.

41. Ans. (1) During fertilization in plants, the pollen tube enters the ovule through the micropyle, the tube nucleus degenerates and the tip of the tube bursts, releasing the male gametes in the vicinity of the embryo sac which they enter. One nucleus fuses with the female gamete, forming a diploid zygote, and the other fuses with the two polar nuclei (or diploid nucleus) forming a triploid nucleus known as the primary endosperm nucleus.

42. Ans. (3) Southern blot is a procedure used for identifying a specific gene, in which DNA from the source being tested is cut into fragments with restriction enzymes and seperated by gel electrophoresis, denaturation into single strands then blotted onto a sheet of nitrocellulose and probed with purified, labeled single-stranded DNA corresponding to a specific gene; if the DNA matching the specific probe is present in the source DNA, it is visible as a band by radioactive label on the sheet.

43. Ans. (4) Thalidomide is a sedative which was most widely used in sleeping pill in the 1960s. When used by pregnant woman, it caused abnormal fetal development resulting in phocomelia (meaning seal-like limbs), in which there is a hand or foot, but no arm or leg. There is evidence that taking a single thalidomide pill in the first weeks of pregnancy is sufficient to cause these tragic birth-defects. Ironically, thalidomide has positive as well as negative features. The drug has been found to be effective in treating leprosy and is being tested against AIDS, cancer, retinal degeneration, and tissue rejection in organ transplants.

44. Ans. (4) Inheritance of attached ear-lobes is an autosomal recessive character. In the pedigree chart given, the parents are heterozygous for the gene. Since attached ear-lobes is an autosomal recessive, it can be expressed only in homozygous recessive condition. So the progeny with attached ear-lobes are homozygous recessive and the others are heterozygous normal and homozygous normal.

45. Ans. (3) In Inversion, a segment of the chromosome is inverted so the the sequence of gene is altered. In pericentric inversion, centromere is involved and in paracentric inversion, inversion of segment takes place on either arm of the chromosome.

46. Ans. (2) The codon AAA codes for amino acid lysine. UUA codes for leucine ; AUG for methionine and CCG for proline.

47. Ans. (2) Antivenom is specific immunoglobulins against snake poison. Treatment of snakebite by antivenom is an artificially acquired passive immunity. Artificially acquired passive immunity is produced by the injection of appropriate levels of specific immunoglobulins.

48. Ans (2) The *Pseudomonas are* a group of bacteria noted for their ability to break down *esoteric* compounds that most microbes shun. In particular various strains of *Pseudomonas* can consume hydrocarbons, which constitute the bulk of oil and petrol. However, each individual strain can utilize only one or a few of the many different types of hydrocarbons. The genes that code for the enzymes which attack hydrocarbons are not found on the main chromosome, but on plasmids. Many species of *Pseudomonas* are pathogenic and are the opportunistic pathogen of humans. And some species of *Pseudomonas* helps in denitrifying of soil nitrate.

49. Ans. (3) DNA is present in mitochondria and chloroplasts. These organelles contain their own DNA, on which are located several genes that produced some of the proteins essential for their own metabolism. But the genes which specify mitochondrial division is in the nucleus. Likewise, the genes that specify chloroplast components are located in the nucleus.

50. Ans. (3) Auxin is synthesized in apical meristems of shoots. It diffuses down stems and suppress the growth of lateral buds. Ethylene is produce around lateral buds under the influence of auxin. The ethylene in turn inhibits growth of the lateral buds. In contrast to auxins, cytokinins stimulate growth of lateral branches. Cytokinins are produced in the roots and transported throughout the plants. So prunning of plants reduces auxins which are synthesized in shoots thus axillary buds are sensitized to cytokinins.

51. Ans. (1) Sugarcane is a monocot plant. In monocots the guard cells are dumb-bell shaped and the leaves shows parallel venation.

52. Ans (2) Potato and sweet potato are analogous organs which are edible parts of the plant.

53. Ans. (3) In *Ulothrix* the sexual reproduction is isogamous. The species may be homothallic or heterothallic. In homothallic species, the isogametes taking part comes from the two different cells of the same filaments, whereas in heterothallic species they come from two different filaments. The gametes fuse to from the zygote. The zygote after a short resting period undergoes meioses and 4 to 16 aplanospores or zoospores are produced.

54. Ans. (4) Gas exchange through the periderm is necessary for the metabolic activities of the living cells of the phelloderm and vascular cambium beneath. This exchange takes place through lenticels areas, of loosely organised cork cells, which often are easily identifiable on the outer surface of bark.

55. Ans. (3) The genetic variability present among cultured cells, plants derived from such cells or progeny of such plants is called somaclonal variation. Generally the term is used for plants or cells obtained from cells obtained *in vitro*. Plants regenerated from tissue

and cell cultures show heritable variation for both qualitative and quantitative traits.

56. Ans (2) In the high altitude birds become rare or extinct, the tree which may disappear along with them is Oak.

57. Ans. (3) Sieve-tube elements are intimately associated with specialized parenchyma cells known as companion cells. Companion cells apparently carry out some of the metabolic functions that are needed to maintain the associated eunucleated sieve-tube members. Companion cells have all of the components of normal parenchyma cells.

58. Ans. (1) Mosses and ferns are found in moist and shady places because they require presence of water for fertilization.

59. Ans. (2) Cork cambium, a second kind of lateral cambium, normally develops first in the pericycle while the vascular cambium is becoming established. Later cork cambia develops in patches from the parenchyma of secondary phloem. The cells that the cork cambium produces outwardly are mainly radial rows of densely packed cork cells. The inner layers contain large amounts of a fatty substance, suberin, which makes the layers of cork nearly impermeable to water.

60. Ans. (2) A cross of the genotype AABBCC and aabbcc will produce the heterozygote progeny AaBaCc in F_1 generation. The different type of gemetes of F_1 progeny will be 8, that is, each gene has two alleles and there are three genes (2^3).

CHEMISTRY

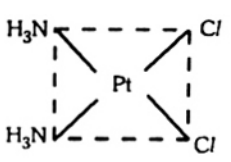
61. Ans. **(3)** Hydroxide of alkaline earth metals are basic that is why $Be(OH)_2$ and $Mg(OH)_2$ is basic. The member of Boron family hydroxides shows a gradual change on moving down the group i.e., from acidic character to basic character via amphoteric character. For example, $B(OH)_3$ (orthoboric acid) is acidic, $Al(OH)_3$ is amphoteric, $Ga(OH)_3$ is also amphoteric and $In(OH)_3$ is distinctly base.

62. Ans.**(2)** Ag^+ ion with CN^- ion (in excess) gives a complex compound having co-ordination number two.

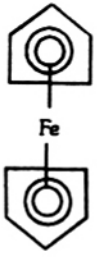
$$Ag^+ Cl^- + Na^+ CN^- \longrightarrow Na^+ \left[Ag(CN)_2\right]^-$$

Complex with co-ordination number two

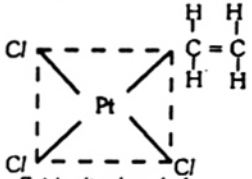
63. Ans. (1) Organo metallic compounds contains one or more metal–carbon bonds. They can be sigma bonded or π–bonded organo metallics. Grignard reagent is an example of former one where as Zeis' salt and Ferrocene are the example of later one. Cis–platin is an anti- cancer agent and it is an example of co-ordination complex compound. It is clear from the structure that cis–platin does not contain any metal–carbon bond.



Cis-platin co-ordination complex



Ferrocene π-bonded organo metallic



Zeis' salt π-bonded organo metallic

$H_3C-Mg-X$

σ-bonded organo metallic

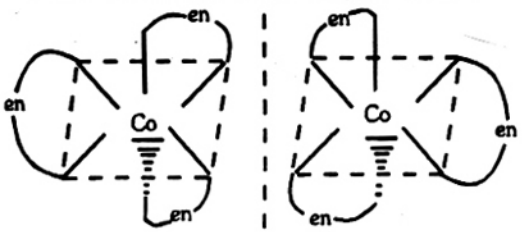
64. Ans. (4) Dimethyl glyoxime,

$CH_3 . C : NOH$
$\quad\quad\quad

It is clear from chemical equation that 2 moles of $KMnO_4$ requires 5 moles of H_2O_2. So, 1 mole of $KMnO_4$ will require $\frac{5}{2}$ moles of H_2O_2.

67. Ans. **(2)** Azide ion (N_3^-) is linear ion. With CS_2 it gives azidocarbon disulphide ($SCSN_3$) it is a pseudohalogen. The formal oxidation state of nitrogen in azide ion (N_3^-) is + 0.33.

68. Ans. (1) The molecule which do not have plane of symmetry exhibit optical isomerism. But $\left[Co(NH_3)_3Cl_3\right]$ is symmetrical in structure, hence, does not show optical isomer



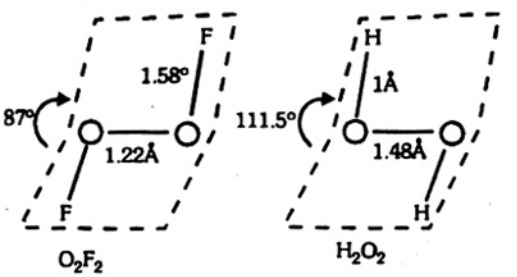
$[Co(en)_3]^{3+}Cl_3$

69. Ans. **(1)** Due to smaller size of fluorine and its charge density it inhibits the incoming electron hence it required some energy to pump one electron inside. So the order of electron affinity is

$Cl > Br > F > I$.

in kJ/ mol 348 340 333 297

70. Ans. **(2)** The O_2F_2 molecule has the same shape as that of H_2O_2 though the dihedral angle is 87°, is rather smaller. The structure of H_2O_2 and O_2F_2 are



71. Ans. (1) In general, solid metals expands or acquire more volume after melting and liquid metals (which exist in liquid state naturally) expands on solidification.

72. Ans. (3) Mercurous chloride (Hg_2Cl_2) is insoluble in water. It is also known as calomel, it forms a white solid precipitate.

$HgCl_2 + Hg \rightarrow \underset{\text{insoluble ppt.}}{Hg_2Cl_2}$

73. Ans. (1) $B(OMe)_3$ is obtained on heating borates with methanol and conc. H_2SO_4. This compound burns with green edged flame.

74. Ans. (4) If central atom contains lone pair of electrons, it repels bond pair therefore, the bond angle (O–N–O) decreases. The compound NO_2^+ does not contains any lone pair on central atom and due to this reason its bond angle will be maximum.

75. Ans. (4) Ionic compound dissociates rapidly in aqueous solution and the value of dissociation constant is higher. The compound $CH_3\overset{+}{N}H_3\ \overset{-}{Cl}$ is ionic compound and its dissociation constant value will be highest among the given list.



76. Ans. (3) The compound is 2° amine hence strong base though it is cyclic but it is saturated system. Rest are 1° and 2° unsaturated structure.

77. Ans. **(1&4)**

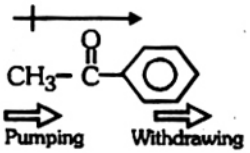
Isobutene contains only primary carbon atom. It is clear from structure. $H_3C-\underset{\underset{CH_2}{||}}{C}-CH_3$

Propyne ($H-C\equiv C-CH_3$) contains primary hydrogen atom.

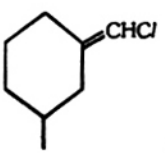
78. Ans. (1) The compound which follows (4n + 2) Hückel rule and which has conjugated system (alternate double and single bond) are aromatic. Compound (2) is 4 n sys-

tem. compound (3) is also $4n$-system compound (4) is not conjugated system. Compound  is conjugated and it has two π electrons.

79. Ans. (3) The maximum value of dipole moment is shown by that molecule which are asymmetrical in structure. Both side of the molecule if contains different groups and these groups shows electron pumping and electron withdrawing effect then molecule will show maximum dipole moment.

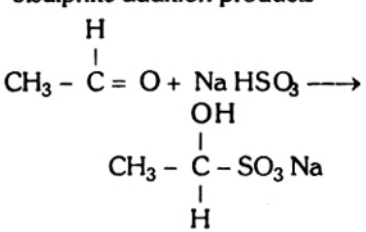


Acetophenone contains C_6H_5 group (electron withdrawing) and CH_3 (electron pumping) group. That is why dipole moment for acetophenone is maximum.



80. Ans. (4) The compound will show Cis-trans geometrical isomerism. This is due to the fact that on the both side of double bond there is bulky group present i.e., methyl and Cl— group.

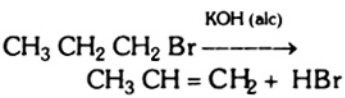
81. Ans. (1) Most of the aldehydes and methyl ketones reacts with $NaHSO_3$ to from sodium bisulphite addition products



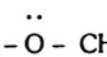
Acetaldehyde. Na. bisulphate addition product.

This bisulphate addition product are crystalline solids hence used for purification of aldehyde and methyl ketone(not for aromatic ketone).

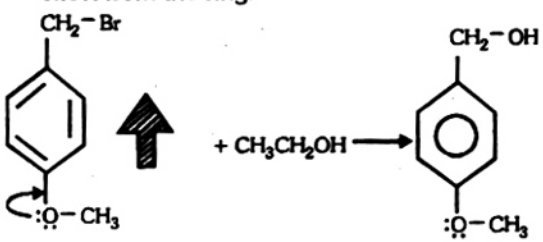
82. Ans. (4) Primary bulky alkyl halides are easily dehydrohalogenated in the presence of alcoholic KOH



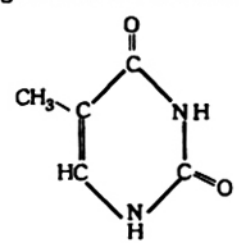
83. Ans. (3) p-methoxybenzyl bromide will react with ethanol easily. It is because ring will resonance stabilize with lone pair of electron of



group and hence $-CH_2-Br$ group will not face any electron withdrawing effect from the ring.



84. Ans. (1) Thymine is a pyrimidine (a nitrogenous base of nucleic acid) having two possible binding site. It is clear from the structure



85. Ans. (3)



86. Aromatic nitrile can not be prepared by ArX + KCN. Only aliphatic nitrile can be prepared by this method

$$R - X + KCN \xrightarrow{C_2H_5OH/H_2O} R - C \equiv N + KX$$

Major product

Rest all process is useful to prepare aromatic nitrile.

87. Ans. (3) Primary amides are highly polar compounds. The inter molecular attractive force in primary amides are maximum that is why all the amides except formamide are solid, therefore, melting point of amides are maximum.

88. Ans. (4) Pyridinium chlorochromate ($C_6H_5\overset{+}{N}HCrO_3\overset{-}{Cl}$) abbreviated as PCC, is a milder reagents which oxidizes primary alcohol to aldehydes. It prevents the formation of carboxylic acid.

$$R\,CH_2\,OH \xrightarrow{PCC(CH_2Cl_2)} R\,CHO$$

89. Ans. (4) The enthalpy of vaporisation of the following compound are in increasing order

$$PH_3 < AsH_3 < NH_3$$

their boiling points are as follows.

PH_3 (– 88° C), AsH_3 (– 55° C),

NH_3 (– 33.5° C)

90. Ans. (2) For principal quantum number n = 4; there will be s, p, d and *f*- orbitals. The azimuthal quantum number i.e, $l = 3$, means *f*-orbitals. There are seven different orientation in a f-sub-shell. These are

$$\underbrace{m = -3, -2, -1, 0, +1, +2, +3.}_{\text{(Seven } f\text{- orbitals)}}$$

To calculate total number of orbitals in the sub-shells $= 2l + 1$.

so, $= 2 \times 3 + 1 = 7.$

91. Ans. (1) Given,

Osmotic pressure of blood = 7. 8 bar = 7. 72 atm.

Temperature = 273 + 37 = 310 K.

NaCl will dissociate in to two ions i.e., Na^+ and Cl^-.

so, i = 2 (vaut Hoff's foctor)

Osmotic pressure, (P) = i C R T.

Concentration of aqueous NaCl

$$\frac{7.72}{2 \times 0.0821 \times 310} \approx 0.16 \text{ mol/L}$$

92. Ans. (3) For the reaction,

$$C_8H_{18} + \frac{25}{2}O_2 \longrightarrow 8\,CO_2 + 9\,H_2O$$

$C + O_2 \longrightarrow CO_{2\,(g)}$; $\Delta H_f^\circ = -490$ J/mol.

$2H + \frac{1}{2}O_2 \longrightarrow H_2O_{(g)}$; $\Delta H_f^\circ = -240$ J/mol

$8C + 9H_2 \longrightarrow C_8H_{18}$; $\Delta_f^\circ = +160$ J/mol

Heat evolved during the combustion of one mole of C_8H_{18}

$= (-490 \times 8) + (-240 \times 9) - (+160)$

$= -6080 + 160 = -5920$ J

for 6 moles $= -35520$ J $= -35.5$ kJ

93. Ans. (1) If the process is in equilibrium as in the problem

$H_2O_{(l)} \rightleftharpoons H_2O\,(g)$ at 1 a/m ; 298 K.

The standard free energy change is equal zero ($\Delta G^\circ = 0$).

94. In the crystal system when the axial rotations are $a = b \neq c$ and the axial angles are $\alpha + \beta = 90°$, $\gamma = 120°$; then the crystal system is *hexagonal* and unit cell or Bravais lattice is simple.

95. Ans. (3) Glycine is N-4 hydroxyphenylglycine are slightly acidic compound.

pH of the solution of glycine can be calculated as

$$Ka_1 = 4.5 \times 10^{-3}$$

and $$Ka_2 = 1.7 \times 10^{-10} \text{ at STP}$$

So, relative strength $= \sqrt{\frac{Ka_1}{Ka_2}}$

or, The pH of solution $\approx$ 6.1

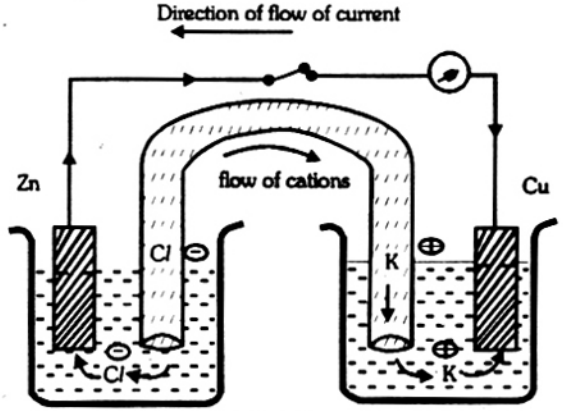
96. Ans. (3) For the following change

$I_{2\,(g)} \rightleftharpoons 2I_{(g)}$; $\Delta H_{f\,298\,k}^\circ = +150$k J

This is endothermic process, so it require to increase the temperature of the system to shift the reaction towards the product.

97. Ans. (3) In the Daniel cell electrons moves from zinc electrode to copper electrode, therefore, by convension current moves from cop-

per electrode to zinc electrode because the direction of current is opposite to the direction of flow of electrion of electron.But from the salt bridge positive or cations move towards copper electrode.



A Daniel cell

98. Ans. (1) Cellulose is a natural polymer, a major constituent of plant life. It is a biodegradable polymer.

99. Ans. (4) For the reaction

$$N_2O_{5(g)} \longrightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$$

It is first order reaction. For a first order reaction involving the dissociation of a reactant, From the expression of rate constant

$$k = \frac{1}{t}\ln\frac{[N_2O_5]_0}{[N_2O_5]_t} \text{ or, } \ln\frac{[N_2O_5]_0}{[N_2O_5]_t} = kt$$

100. Ans. (1) Ozone layer in stratosphere is sepleted by chlorofluoro carbon of Feron i.e., CCl_2F_2.

$$CF_2Cl_2 \xrightarrow{h\nu} Cl^{\cdot} + C^{\cdot}F_2Cl$$

Free radicals.

$$Cl^{\cdot}_{(g)} + O_{3(g)} \longrightarrow ClO^{\cdot}_{(g)} + O_{2(g)}$$

(ozone deplection).

$ClO^{\cdot}_{(g)} + O_{(g)} \longrightarrow Cl^{\cdot}_{(g)} + O_{2(g)}$ (further growth of free radical).

PHYSICS

101. Ans. (3) The motor boat produces two types of disturbances in water as:–

(i) During sailing in water, it disturbs the surface of water, which causes the transverse waves in water.

(ii) Again the boat produces sound which also propagates through the water. And we know that the sound wave in water is longitudinal.

So, it produces both the longitudinal as well as the transverse wave in water.

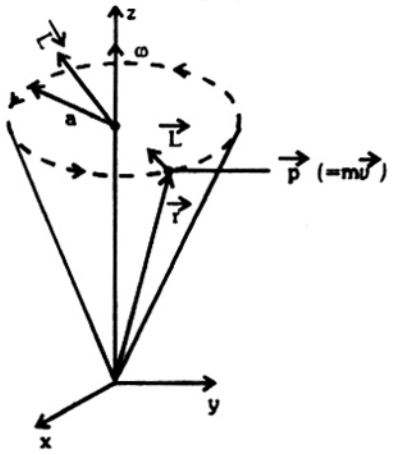
102. Ans. (2) The angular momentum is as

$$\vec{L} = \vec{r} \times \vec{p}$$

where $\vec{r}$ = Radius Vector

$\vec{p}$ = Linear Momentum Vector

The direction of angular momentum $\vec{L}$ is perpendicular to the plane formed by $\vec{r}$ and $\vec{p}$ which means that $\vec{L}$ is not parallel to ω as shown in the following figure:–



Explanation of figure:–

A particle of mass m is rotating with velocity $\vec{v}$ in a circle of radius 'a' about the z-axis of an intertial frame of reference, then the direction of angular momentum vector is as shown in the above figure.

When we see the formula it looks like that $\vec{L}$ is parallel to the linear momentum. But this is not the exact fact. Always, for the orbital mo-

tion, the angular momentum is perpendicular to the orbital plane.

103. Ans. (3) The mass of nucleus

$$= m = A \text{ (a.m.u.)}$$

The momentum of the nucleus before emission of α -particle is zero.

Now the mass of α-particle

$$= m_\alpha = 4 \text{ (a.m.u)}$$

So, p_α = momentum of α -particle.

$$= m_\alpha \cdot v$$
$$= 4v$$

Now $p_{residual}$ = momentum of residual nucleus

$$= m_{residual} \times V$$
$$= (A - 4).V$$

[because $m_r = A - 4$ (a. m. u.)]

According to the conservation of momentum, both moves in opposite direction. So,

$$4v - (A - 4).V = 0$$
$$\Rightarrow \quad (A - 4).V = 4v$$
$$\therefore \quad V = \frac{4v}{(A - 4)}$$

104. Ans. (2) The energy equivalent of mass of the electron and positron is 0.51 MeV.

So, the total energy released

$$= 0.51 \text{ Mev} \times 2$$
$$= 1.02 \text{ MeV}$$
$$= 1.02 \times 10^6 \text{ eV}$$
$$= 1.02 \times 10^6 \times 1.6 \times 10^{-19} \text{ J}$$
$$= 1.63 \times 10^{-13} \text{ J}$$

105. Ans. (1) The terminal velocity is the maximum constant velocity acquired by the body while falling freely in a viscous medium

If the body is a sphere, then the terminal velocity of that sphere in the viscous liquid is

$$v = \frac{2.R^2(\rho - \rho_o).g}{9\eta}$$

where R = Radius of the body (sphere here)

ρ = density of the body

$$= \frac{M}{V}$$

ρ_o = density of the liquid

$$= \frac{M_o}{V}$$

η = coefficient of viscosity

So from the above formula

$$v \propto R^2$$

106. Ans. (3) Since we know that the frequency of vibration of the mass attached with the spring is

$$v = \frac{1}{2\pi}\sqrt{K/M}$$

where K = Spring constant.

And in the case of spring if there are two springs, then their spring constants can be added to from the total spring constant of the system as

$$K = K_1 + K_2 + - - -$$
$$= K + K = 2K$$

So, the frequency is now

$$v = \frac{1}{2\pi}\sqrt{2K/M}$$

107. Ans According to the Einstein's photoelectric effect, the relation is as:—

Energy of coming photon

= work function of the substance

+ K. E. of photoelectron.

Here the incident photon having energy 4 eV and the work function 2 eV. So the K.E. acquired by the photoelectron is

$$K.E. = 4eV - 2 \text{ eV}$$
$$= 2 \text{ eV}$$

But according to the question our task is to stop the emission of electron. i.e. there should not be K. E. acquired by the photoelectrons. So, to stop the electron, we have to apply some reverse potential. And as we know the potential corresponding to 2 eV is 2V. So, the reverse potential of 2V is applied to stop the emission of photo electrons having energy of 2 eV.

108. Ans. (1) In magnetic field, the Lorentz law gives, $F = Bqv$

where B = magnetic field

q = charge on the particle

v = velocity of the particle.

The another force on the particle is centrifugal

force = $\frac{mv^2}{r}$

where r = radius of the circular path.

For the stability of the system, both the forces will balance each other i.e.

$$\frac{mv^2}{r} = Bqv$$

$$\Rightarrow \quad r = \frac{mv}{Bq} \text{ ------ (1)}$$

Now the radius of circular path formed by α-particle is

$$r_\alpha = \frac{m_\alpha . v}{B . q_\alpha}$$

$$= \frac{4 \times m_p \times v}{B \times 2 q_p} \text{ ------ (2)}$$

where q_α = charge on α - particle

$= 2 \times q_p$

(where q_p = charge on proton)

m_α = mass of α– particle

$= 4 \times m_p$

(where m_p = mass of proton)

Similarly, r_p = radius of circular path formed by proton is

$$= \frac{m_p . v}{B q_p} \text{ --------- (3)}$$

From equation (2) and (3)

$$\frac{r_p}{r_\alpha} = \frac{m_p . v}{B . q_p} \times \frac{B . 2 q_p}{4 . m_p . v} = \frac{2}{4} = \frac{1}{2}$$

$$\therefore \quad r_p : r_\alpha = 1 : 2$$

109. Ans. (1) the positrons are positive electrons i.e. having the mass of equal to electron and unit +ve charge.

Now, when the two beams of the positron are coming together and separated by a small distance, then due to the same charge on the beam they repell each other.

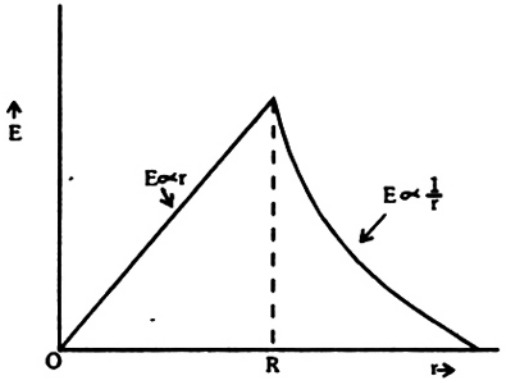
When we place one magnet, in that case, the beam will deflect normal to the plane containing the two beams.

110. Ans. (2) Actually

$E \propto r$ for the region $r < R$

and $E \propto \frac{1}{r}$ for the region $r > R$.

So, the graph between E and r is as follows:–



111. Ans. (1) If we draw a surface in such a way that the electric potential is the same at all the points lying on the surface, it is called an equipotential surface. The component of electric field parallel to an equipotential surface is zero because the potential does not change in this direction. Thus the electric field is perpendicular to the equipotential surface.

In our question, the equipotential surface is increasing in the x-direction. So, the electric field is in the perpendicular direction of axis i.e. parallel to YZ-plane

112. Ans. (2) According to the Stefan -Boltzmann formula of thermal radiation, we know that

$$u = \sigma T^4 . A$$

$$= \sigma T^4 . (\pi r^2)$$

where σ = Stefans constant

T= temperature of the body

r = radius of the spherical body.

According to the question

$$u_1 = \sigma T^4 . \pi r^2$$

$$u_2 = \sigma \left(\frac{T}{2}\right)^4 \times \pi \times (100\, r)^2$$

$$= \frac{\sigma T^4}{16} \times \pi \times 10000 \times r^2$$

$$\therefore \frac{u_2}{u_1} = \frac{\sigma T^4 \times \pi \times 10000 \times r^2}{16} \times \frac{1}{\sigma T^4 . \pi r^2}$$

$$= \frac{10000}{16}$$

$$\frac{u_2}{u_1} = 625$$

113. Ans. (2) Generally in metal if the temperature increases, the resistance of the metal increases and conductivity decreases and vise-versa

But the opposite happens in the semiconductor i.e. as the temperature increases the resistance decreases and conductivity increases and vise-versa

This relation between temperature and resistivity of semiconductor is linear in nature so, the graph is simply decreasing graph

114. Ans. (3) According to the continuity equation, the total mass of fluid going into the tube through any cross-section is equal to the total mass coming out the same tube from other cross section in the same time i.e.

$$A_1 v_1 = A_2 v_2 = \text{constant}$$

where A = C. S. A

v = Velocity of the fluid.

In our problem, we need the relation between Pressure and Velocity based on the continuity equation. Bernoulls principle is true for that as it relates

$$P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$$

so, the relation is followed by Bernoulli's principle.

115. Ans. (4) From the Biot-Savert law, we know that the magnetic field $\vec{B}$ along the axis of the circular wire is

$$B = \frac{\mu_o \cdot i \cdot R^2}{2(R^2 + r^2)^{3/2}}$$

where R = Radius of the circular wire

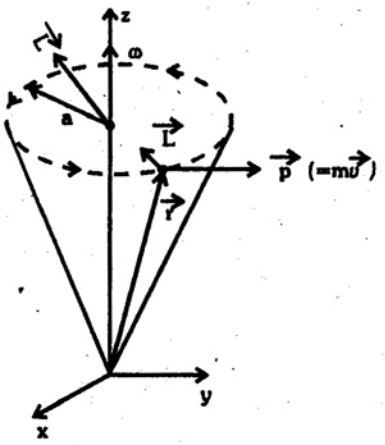
r = distance of the point of reference along the axis of the circular wire,

when $r >> R$, then

$$B = \frac{\mu_o \cdot i R^2}{2 r^3}$$

$$\Rightarrow \quad B \propto \frac{1}{r^3} \text{ as } \frac{\mu_o \cdot i R^2}{2} = \text{constant}$$

116. Ans. (4) If a single particle of mass 'm' moves with velocity $\vec{v}$ in a circle about the z-axis, of an intertial frame of reference, then the direction of angular velocity ω lies on the Z-axis and points upward as shown in the figure



117. Ans. (1) Actually in foggy weather, the light can not travell more. So, we need a light which can travell less distance in foggy weather. For that we need one light which can scatter less by the fog particle so that we can get the illuminisance at a far distance also. And the nature of yellow light is that, it can scatter less by the fog particle and gives illuminance at a far distance also.

So, we are preffering sodium lamp which gives yellow light in foggy weather.

118. Ans. (1) From the Biote-Savert law, we know that the magnetic field:–

For inside i.e. $r < a$, is

$$B = \frac{\mu_o}{4\pi} \frac{2I \cdot r}{R^2}$$

$$\Rightarrow \quad B \propto r$$

Again for outside i.e. $r > a$

$$B = \frac{\mu_o}{4\pi} \times \frac{2I}{r}$$

$$\therefore \quad B \propto \frac{1}{r}$$

119. Ans. (2) All the V – t graphs except (2) shows the reverse time i.e.–ve time, which is not possible.

120. Ans (4)Momentum before collision =0

According to the conservation of momentum. The total momentum before collision.

= total momentum after collision

$\Rightarrow \quad 1 \times 80 - 2 \times v = 0$

where velocity is -ve because both the fragments will move in opposite direction.

$\Rightarrow \quad 80 = 2v$

$\Rightarrow \quad v = 40$ m/sec.

Again the total energy impact is the sum of their Kinetic Energies i.e.

$$K.E_1 + K.E_2$$

$$= \frac{1}{2} \times m_1 \times v_1^2 + \frac{1}{2} m_2 \times v_2^2$$

$$= \frac{1}{2} \times 1 \times (80)^2 + \frac{1}{2} \times 2 \times (40)^2$$

$$= 80 \times 40 + 40 \times 40$$

$$= 3200 + 1600$$

$$= 4800 J$$

$$= 4.8 KJ$$

121. Ans. (3) When the monochromatic light is passed through the thin film of mica, the light remains monochromatic. So that the fringes formed due to the interference of the monochromatic light will remain the same. But due to the thin mica sheet, the wavelength of the monochromatic light will change. So the fringe pattern will obviously shift either upward direction or downward direction. But the width of the pattern will remain the same.

Note:– when the monochromatic light looses its monochromatic character, in that case the fringe pattern disappears.

122. Ans. **(4)**

When the two mediums are coming in contact and one becomes invisible, it means that their refractive index are matching

123. Ans. (2) Fundamental frequency

$$= v_o = 1500 \text{ Hz}.$$

And the maximum audible frequency

$$= 20000 \text{ Hz}$$

So number of overtones

$$= 2n = \frac{v}{v_o} = \frac{20000}{1500}$$

$$= \frac{40}{3} \approx 13$$

$\therefore \quad n = 6.5$

so the maximum number of overtones generated equals to 6.

124. Ans. (1) Magnetic Resonance Imaging :- The magnetic resonance imaging is related to the nuclear magnetic resonance. Actually the image shows the effect of that body on the surroundings. Due to the magnetic resonance imaging, we can find out the nuclear size, the r-cascading etc.

Now due to the electron spin resonance, we can have the wave nature of the electron

Electron paramagnetic resonance gives the magnetic properties of material

125. Ans. (2) The carbon having half life as 5600 years. So the range of the half life of the carbon is in the range of 10^3 years to 10^4 years. The best performance of the exact calculations of the age limit is in the range of the just above of their half life period. i.e. the range of the carbon dating which is best suited for determining the age of fossils having in the order of 10^4 years .

126. Ans. (3) According to the question

C = capacitance

$= 40 \mu F = 40 \times 10^{-6} F$

$V = 3000 V$

$t = 2$ m sec

$= 2 \times 10^{-3}$ sec.

$$E = \frac{1}{2} Q . C$$

$$\mathbf{E = \frac{1}{2} \times V^2 C}$$

$$= \frac{1}{2} \times (3000) \times 40 \times 10^{-6}$$

$$= \frac{1}{2} \times 9 \times 40 = 180$$

$$\text{power} = \frac{E}{t}$$

$$= \frac{180}{2 \times 10^{-3}}$$

$$= 90 \times 10^3 = 90 \text{ KW}$$

127. Ans. (1) This is the case of mixed circuits i.e. cells having internal resistances and the outer resistance is connected in rows and columns. For that circuit, the total current I flows

$$= I = \frac{m.\,n.\,E}{nr + mR}$$

where

m = number of cells in parallel rows = 100

n = number of cells in a single row = 5000

E = e.m.f of each cell = 0. 15 V

r = 100 resistance of each cell = 0.25 Ω

R = outer resistance i.e. resistance of the parallel cell = 500 Ω

$$\therefore \quad I = \frac{100 \times 5000 \times 0.15}{5000 \times 0.25 + 100 \times 500}$$

$$= \frac{500000\ (\times 0.15)}{500\ (10 \times 0.25 + 100)}$$

$$= \frac{150}{2.5 + 100}$$

$$= \frac{150}{102.5} = 1.5 \text{ A}$$

128. Ans. (2) According to the reversible cycle the equation of state is

$$PV = n\,RT$$

So, At the position A, we have

$$P_o V_0 = n\,RT_o \text{ ----------(1)}$$

Again at the position B,

$$(2\,P_o) \cdot V_o = n\,RT_1$$

$$\Rightarrow \quad 2\,(P_o V_o) = n\,R\,T_1$$

$$\Rightarrow \quad 2 \times n\,R\,T_o = n\,R\,T_1$$

(because $P_o V_o = n\,RT_o$)

$$\Rightarrow \quad T_1 = 2\,T_o$$

Now the efficiency of the cycle is

$$\eta = 1 - \frac{T_o}{T_1} = 1 - \frac{T_0}{2\,T_o}$$

$$= 1 - \frac{1}{2} = 0.5$$

So the % efficiency = 50 %

129. Ans. (3) Actually the liquid oxygen having the ferromagnetic behaviour. The ferromagnetic substances caused by a domain structure. Such type of substance has a large susceptibility. It shows the hysterisis cycle.

The paramagnetic substance is having small susceptibility. The paramagnetic behaviour is due to the unpaired electron spins.

The diamagnetic substance having the -ve susceptibility. The diamagnetism is a weaker effect than paramagnetism and ferromagnetism.

In these materials, the materials having two or more types of atoms with magnetic moments. The magnetic moment of one type can align antiparallel with those of the other type.

In antiferromagnetism, the susceptibility increases with temperature upto a certain point. Above this temperature the material becomes paramagnetic

Note:- Ferrimagnetism is a particular form of antiferromagnetism.

130. Ans. **(3)**

131. Ans. **(2)** According to the question it is given that

$$\lambda = 100 \text{ pm} = 10 \times 10^{-12} \text{ m}.$$

The energy $E = h\nu$

$$= \frac{h.\,C}{\lambda} \quad \left(\text{because } \nu = \frac{C}{\lambda}\right)$$

where h = Planck's constant

$$= 6.6 \times 10^{-34} \text{J . sec}$$

$$= \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{10 \times 10^{-12}} \text{ J}$$

$$= 1.98 \times 10^{-14} \text{ J}$$

$$= \frac{1.98 \times 10^{-14}}{1.6 \times 10^{-19}} \text{ eV}$$

$$= 1.23 \times 10^5 \text{ eV}$$

$$= 123 \times 10^3 \text{ eV} = 123 \text{ keV}$$

$$= 12.3 \text{ keV} \approx \text{app. } 15$$

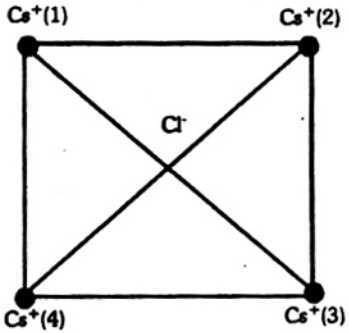
132. Ans. (3) The colours we are seeing after reflection is generally a phenomenon of inter-

ference except the colours shown by the prism which is a dispersion phenomenon.

Actually the disc contains so many layers. When the white light gets reflected from these different layers, then they interfere with each other. Due to these interference we see the colours

133. Ans. (4) Here all the diagonal charges with Cl^- having opposite directions. So they cancel each other.

Let us see this in details. (take one face)



The direction of force of Cl^- with Cs^+ (1) is opposite to the direction of force of Cl^- with Cs^+ (3). So these forces cancel each other.

Again in similar way, the direction of force between Cs^+ (2) and Cl^- is opposite to the direction of force between Cs^+ (4) and Cl^-. So, they cancel each other.

Similar thing happens for all the Cs^+ ions. And the net electrostatic force exerted by the eight Cs^+ ions on Cl^- ion becomes zero.

134. Ans. (4) We know that the magnetic moment of current is

$$M = N.I.A$$

where

N= number of turn's of the coil

I = amount of current flowing through it

A = cross sectional area = πr^2

so, $M = N.I.(\pi r)^2$

It shows that $M \propto r^2$

135. Ans. (4) Cyclotron is a device for accelerating charged particles to high energies. In this device, the particles are injected near the centre of an evaccuated space between two 'D' - shaped boxes placed between the poles of a strong permanent magnet. Within these dec, the particles describe a semicircular orbit. The frequency of that revolving charged particle is

$$\nu = \frac{B.q}{2\pi.m}$$

Here given that

$B = 1$ Tesla

q = electron charge

$= 1.6 \times 10^{-19}$ C

$m = 9.1 \times 10^{-31}$ kg

$$\therefore \quad \nu = \frac{1 \times 1.6 \times 10^{-19}}{2\pi \times 9.1 \times 10^{-31}} \text{ Hz}$$

$$= 2.8 \times 10^{10} \text{ Hz}$$

$$= 28 \times 10^{9} \text{ Hz} = 28 \text{ G Hz}$$

(10^9 is called giga)

136. Ans. (1) The experiments shows that due to the increase of the mass number. the binding energy increases at a particular value of 56 nucleons. After that when we increases the nucleon number the binding energy of the nucleons starts decreasing. This is a topic of research; why it so happens.

137. **gate:-** gate is basically a circuit that has one or more inputs but only one output. It can also be understand that the signal that enables a circuit to function. It gives output proportional to the input.

There are basically three fundamental gates

(1) OR gate

(2) AND gate

(3) NOT gate

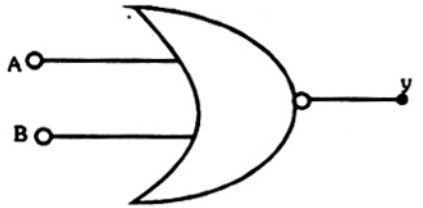
(1) The OR gate having the AND operation.

If we have two inputs as A and B, then, the output is as in following table.

INPUT		OUTPUT
A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

This table is called truth table

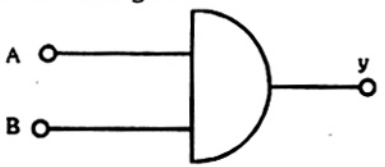
The symbol of OR gate is,



(2) The AND gate having the or operation. If we have two inputs as A and B, the output is as in the following table.

Input		Output
A	B	(Y)
0	0	0
0	1	0
1	0	0
1	1	1

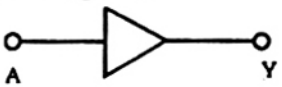
This is called the truth table of AND gate.
Symbol of AND gate is



(3) The NOT gate having the opposite operation. The truth table of NOT gate is

Input	Output
0	1
1	0

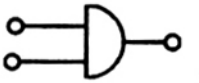
Symbol of NOT gate is



The other gates are the mixed gates like NOR, NAND etc.

The NOR having OR and NOT operation simultaneously.

NAND having AND and NOT operation simultaneously

Now from the figure given in question we see that we have the symbol  which resents NOT gate and  which represents OR gate. So, in combined the OR gate and NOT gate constitutes NOR gate.

138. Ans. (1) In semiconductor

$$n_i = \sqrt{n.\,p}$$

where n = number of electron concentration
p = number of hole concentration
n_i = intrinsic concentration

given that $n_i = 10^{19}$

and $p = 10^{21}$

$\Rightarrow \quad \sqrt{n \times 10^{21}} = 10^{19}$

$\Rightarrow \quad n \times 10^{21} = 10^{38}$

$\therefore \quad n = \dfrac{10^{28}}{10^{21}} = 10^{17}/m^3$

139. Ans. **(2) Since**

Root Mean square Velocity

$$V_{rms} = \sqrt{\frac{3KT}{M}}$$

Most Probable Velocity

$$V_{mp} = \sqrt{\frac{2KT}{M}}$$

Average Velocity

$$V_{A.V} = \sqrt{\frac{8KT}{\pi M}}$$

$$= \sqrt{2.54 \times \frac{KT}{M}}$$

when we compare these velocities we conclude that

$$V_{rms} > V_{AV} > V_{mp}$$

140. Ans. (2) From the coulomb's law of force, we know that

$$F = \frac{1}{4\pi \epsilon_0} \frac{q_1 \cdot q_2}{r^2}$$

where q_1 and q_2 = charge on the body which come in electric field
r = seperation between them.

$$\Rightarrow \quad \epsilon_0 = \frac{q_1 \cdot q_2}{4\pi . F r^2}$$

4π is a dimension less quantity

q_1 and q_2 having dimension of

Amp × Time = A.T.

Force having dimension = $M L T^{-2}$

So, $\epsilon = \dfrac{[AT]^2}{[MLT^{-2}] \times [L^2]}$

$= A^2 T^2 \times M^{-1} \times L^{-1} \times T^2 \times L^{-2}$

$= M^{-1} L^{-3} T^4 A^2$

ASSERTION AND REASONING

BIOLOGY

141. Ans (1) The Insecticidal properties of DDT (Dichloro-Diphenyl -Trichloroethane) was discovered in 1934 by Swiss chemist Paul Muller. It was used to control potato beetles in Switzerland in 1939 and commercial production began in 1943. DDT seemed like a wonderful discovery. It is cheap, stable, soluble in oil, and easily spread over a wide area. It is highly toxic to insects but relatively non toxic to mammals. Where other control processes act slowly and must be started before a crop is planted, DDT can save a crop even when pests already are well established. Its high toxicity for target organisms make DDT very effective. DDT seemed like the magic bullet for which science had been searching. It was sprayed on crops and houses, dusted on people and livestock, and used to combat insects all over the world.

DDT has been spread so widely that fifty of the sixty malaria carrying mosquitoes are now resistant to it and the environmental side effects outweighs its benefits. Before DDT was introduced in 1949, cotton yields were about 500 kg per ha. By 1952 yields has risen to nearly 750 kg per ha, but DDT resistant boll weevils also had appeared and it became ineffective. Even worms. *Heliothis worm* which had not previously been a problem began increasing rapidly. By 1955, cotton yields were down to 330 kg per ha, one- third less than before pesticides were used.

142. Ans (2) Antidiuretic hormone (ADH, also known as vasopressin) is secreted by the posterior lobe of the pituitary gland. It stimulates water retention by the kidneys and thus conserve water. In diabetic insipidus, ADH is not produced by the pituitary. The kidneys do not retain water and excessive quantities of urine are produced.

143. Ans (1) Oparin considered that protein molecules were crucial to the transformation from inanimate to animate. Coacervates are spherical aggregation of lipid molecules in water, held together by hydrophobic forces. These colloid- rich coacervates may have been able to exchange substances with their environment and selectively concentrate compounds within them, particularly crystalloids. It is suggested that substances within the coacervates may have undergone further chemical reactions and, by absorbing metal ions into the coacervates. Pre-existing molecules capable of self replication may have incorporated into it and produced a primitive type of cell. It increases in size and produced a primitive self-replicating heterotrophic organisms feeding on an organic-rich primedial soup.

144. Ans (3) Tapeworm, roundworm and pinworm are endoparasites of human intestine. The source of these intestinal parasitic worms are due to intake of improperly cook food and ingestion of cyst along with contaminated vegetables, etc. But the source of all intestinal infections are not due to improperly cooked food.

145. Ans (2) Fish meal has been widely used as a supplemented protein source for many years primarily for monogastric animals. Fish meal can be classified as two basic types; (1) fishery waste associated with the processing of fish for human consumption and (2) fish that are only used for the production of fish meal. The composition of fish meal can vary considerable depending upon the composition (whole fish, fish scraps, etc.) of the substrate that is used to prepare the fish meal. Specific fishes like herring, menhaden pollack, etc, are harvested just for the purpose to produce fish meal. Fish meal is the primary supplemented protein source that is feed to livestocks. The

lipids associated are highly unsaturated and highly susceptible to be oxidized. Amino acid quality of fish is excellent, but excessive heating during the drying process can reduce digestibility. Fish meal is often used as a bypass protein source for feeding applications for lactating dairy cattle.

146. Ans (2) To adapt in different environmental conditions, animals adapt different strategies. Those animals that cannot adapt properly are eliminated in the course of time. And those that are adapted are favoured by natural selection and continue from generation to generation. Many animals shows mimicry to protect themselves from the predator. Praying mantis is green in colour and merges with green foliage to hide from predators.

147. Ans (1) Each human cell contains 46 chromosomes however, in Orangutan, chimpanzee and gorilla the chromosome number is 48. A difference of 2 chromosomes makes what we are from these great apes. Chimpanzees are considered as the closest relative of the present day humans because chimpanzees have a high IQ and anatomical similarity. The banding patterns of human chromosomes is very much similar and identical to the banding patterns of apparently homologous chromosomes in great apes. This can be seen in banding pattern of chromosome 3 and 6 of men and chimpanzee respectively.

148. Ans (4) Dope test is used to estimate the level of certain drugs present in urine and blood. Breath tests for alcohol are an indirect yet most practical way of estimating alcohol intoxication. In 1938, Dr. R.N. Harger developed the first testing instrument, called the Drunkometer, which was followed in 1941 by the Intoximeter, developed by Glenn Forester, and the Alcometer, developed by Prof. Leon Greenberg. All of these machines were designed to take a deep air sample (breath from the alveolar sacs, the site of gas exchange in the lungs) and calculate the rate or proportion of alcohol in blood to alcohol in breath. This proportion is known as the partition rate, and since 1938, it has been generally accepted that the ratio is approximately 1 to 2,100. The estimated alcohol in-blood using this proportion became referred to as BAC (blood alcohol concentration), the percent weight by volume, or % w/v, based upon grams of alcohol per cubic centimeter of blood or 210 litres of breath). Alcohol is absorbed in stomach and it increases the flow of blood.

149. Ans (2) Honey bee queens fly only once, during their famous nuptial flights taken shortly after they emerge as adults. During this flight, they mate and acquire sperm that they must store in the reproductive tract to last a lifetime. Queens lead a mostly sedentary life within the hive, where they are fed and cared by workers. It can lay fertilized as well as unfertilized eggs. Unfertilized eggs developed into males whereas fertilizes eggs develop into females. A queen or a worker may arise from the same egg, depending on the amount and type of food given to the larva by the nurse bees. Larvae destined to become queens receive large meals that stimulate the secretion of juvenile hormone. When this hormone is not present at a critical time in development, the larva's ovaries degenerate and the bee develops into a sterile, but genetically female, worker.

150. Ans (2) Human gestation period is considered to be 38 weeks (from conception), or 40 weeks from the onset of the last menstrual period. Variation from this (two weeks prior or after) is considered normal. More than that is "premature, or postmature". Most of the critical events in human development occur in the first month of pregnancy. Cleavage occurs during the first week, gastrulation during the second week, neurulation during the third week, and organogenesis during the fourth week. The second and third months of human development are devoted to morphogenesis and to the elaboration of the nervous system and sensory organs. By the end of this period the development of the embryo is essentially complete. During the last six months before birth, the human fetus grows considerably, and the brain produces large numbers of

neurons and establishes major nerve tracts. Most of the weight of fetus is added in the final three months. Allometric growth occurs when an organ grows at a different rate from the rest of the body. This produces a change in size of the organism which is accompanied by a change in shape of the organism. Most vertebrates, including mammals develop in this way. For instance in humans, there is changing proportions of the human body during fetal development. There is disproportionately large head in the embryo at 2 months, and the more rapid growth of trunk, arms and legs thereafter.

151. Ans (1) Natural selection can only operates if there is 'variation'. Variation is largely due to a reshuffling of the genes when the genetic instructions from the two parents come together. Natural selection acts on variation by favouring some animals over others. Animals survive in the world by being able to obtain sufficient food for their needs, as well as water, adequate shelter and so on. Furthermore, to produce offsprings, they must successfully engage in mating, giving birth, and caring for the young. It is in this aspect of life that the selection process operates, for all individuals produce more offsprings than will eventully survive. Because of variation it follows that some individuals are likely to be more capable than others. It is these, the 'fittest', who survive, who thrive, and who leave most offsprings of their own behind them.

152. Ans (3) Ginger has a prostrate growing rhizome. Tropism is a movement of parts of a plant in response to, and directed by, an external stimulus. The movement is almost always a growth movement. Shoots and coleoptiles are negatively geotropic, roots are positively geotropic, that is, it grow downwards, and shoots are negatively geotropic; it grows upward. Gravity is the stimulus responsible for geotropism. Opposite responses of roots and shoots are due to different sensitivities to auxin. High auxin concentration stimulates growth on lower side so shoot grows upwards.

153. Ans (1) Protoperiodism is defined as the response of a plant to the relative length of light and dark periods. The pigment responsible for absorbing light involved in photoperiodic phenomena of plants is the phytochrome. This pigment is also involved in the perception of photoperiodic stimuli controlling flowering, seed germination and other morphological phenomena. Phytochrome is a protein with a chromophore (pigment coloured protein) prosthetic group (e.g., chromoprotein) that resembles, in basic structure the open chain tetrapyrrole chromophore of the algal pigment 6- phycocyanin. There are two forms of phytochrome : the phytochrome red absorbing form (Pr) and the phytochrome far-red absorbing form (pfr). Pfr form is the physiologically active form. The two forms are photochemically inter-convertible. Pfr below a critical level will promote flowering in a short day plant. Pfr is required for flowering in both long and short day plants.

154. Ans (2) In chloroplast and all but the most primitive bacteria, light is captured by a photosystem, a network of chlorophyll molecules held within a protein matrix on the surface of the photosynthetic membrane. In cyclic photophorylation, electrons ejected from the pigment by light travel a circular path driving a proton pump and then returning to the photocenter where they originated. For every three electrons, the energy yield is one ATP molecule. Cyclic photophosphorylation is seen in most primitive bacteria and in sulfur bacteria.

Plants and algae use a two-stage photocenter. First a photon is absorbed by photosystem II, which passes an electron to photosystem I and this energized electron drives a proton pump and generates a molecule of ATP Then, a proton is absorbed by photosystem I, energizing an electron that is used to provide reducing power in the form of NADPH. The electrons and associated protons that oxygen forming photosynthesis employs to form energy rich reduced organic molecules are obtained from water. The residual oxygen atom

of the water molecules combine to form oxygen gas.

155. Ans (1) The legumes, obtained fixed nitrogen through a symbiotic association with soil bacteria of the genus *Rhizobium*. The symbiotic relationship between legumes and *Rhizobium* seems to be species- specific. The actual site of nitrogen fixation is in the nodules formed in the roots of the legume plant as a result of penetration of rhizobia. The bacteria either penetrate the relatively soft root hair tip or invade damaged or broken root hair and progress in as infection thread through the cortex tissue to the immediate area of the endodermis and pericycle. Through nodulation, the microorganisms provide the host plant with fixed nitrogen, and the host plant provides the microorganisms with soluble carbohydrates.

Root nodules shows the presence of red pigment called leghemoglobin. Leghemoglobin is an oxygen carrier, the oxygen (O_2) is necessary for the electron transport chain of the rhizobium bacteroid. Because of its very high affinity for oxygen, leghemoglobin provides oxygen to the root nodules bacteria quickly, even at very low levels of free oxygen. Leghemoglobin keeps levels of molecular oxygen low in the bacteriod. This function is particularly important because nitrogenase is sensitive to O_2 and loses activity in its presence.

156. Ans (1) Red algae are important members of coral reefs. Red algae are unusual among the algae because they can include in their cell walls calcium carbonate which makes the plants hard and resistant to wear. Red algae that grow this way are referred to as " coralline" algae, because they are hard like corals. In addition to the common upright forms of coralline algae some species can grow in a thin mat over rocks and other hard structures. are called crustose when growing in this form. The upright and crustose forms of red algae bind and infill coral skeletons to form massive sedimentary structures which are strong enough to resist wave action and erosion.

157. Ans (4) Honey is the chemically altered form of nectar. The crop or honey sac of bees changed nectar into honey by losing a certain amount of water and becoming chemically altered. The salivary enzyme converts the complex sugar of nectar into the simple sugar of honey. Insects visit flowers mostly to gather nectar. Most insects locate source of flood initially by odor, then orient themselves on flower or group of flowers by its shape, colour and texture. Some bees collect nectar which is used as a source of food for adult bees and occasionally for larva. Most of the approximately 20,000 species of bees visit flowers to obtain pollen. Pollen is used to provision cells in which bee larvae complete their development.

158. Ans (2) Coconut tree is distributed in coastal areas over a large part of the world. In India, coconut is seen in many places. It is cultivated mostly in Kerala, Tamil Nadu and Karnataka. Coir is the term applied to the short coarse, rough fibres which make up the greater part of the husk of the fruits of the coconut palm. The coconut fibres are very light, elastic and highly resistant to water. So coconut can float and get dispersed over thousands of kilometers before losing viability.

159. Ans (3) Sulfur deficient plants show chlorosis of the younger leaves first, followed by the production of anthocyamin pigments in some species. Under sever conditions, however, all of the leaves may undergo some loss of green colour. Sulfur deficiency also resulted in a marked decrease of stroma lamellae and an increase in grana stacking. Chlorosis is also seen due to the deficiency of nitrogen. The symptom in nitrogen deficiency first seen in more mature leaves and last in the upper, more actively growing leaves. It appears in the younger leaves last because of the high mobility of nitrogen in plants. Sulphur is present in protein structure in the form of the sulfur bearing amino acids cystine, cysteine, and methionine. Sulfur is taken up by plants as sulfate ion SO_4^{2-}. Sulphur is not a component of nucleic acid.

160. Ans (2) In embryo transfer in cattle, a genetically superior and high productivity female serves as donor of embryos to be transferred. The donor females are treated with appropriate doses of the selected gonadotrophin, e.g., follicle stimulating hormone (FSH) or luteinising hormone (LH), to increase the number of ova released at the time of ovulation; this is called superovulation. A single female can provide 15 embryos at a single cycle. When the donor female is in heat (oesters), it is artificially inseminated using semen from a genetically superior bull of top pedigree. Fertilized eggs/young embryos are collected by flushing the uterus of superior donor females with a special nutrient solution; this is done 7 days after the insemination. Selected embryos are incubated in a special nutrient medium at 37° C and then transfer into inferior surrogate mothers. Single embryo is transferred into the uterus of each surrogate mother. Progeny obtained by embryo transfer are of superior genotype since the maternal and paternal genes are from superior donor females and superior males respectively.

CHEMISTRY

161. Ans. (1) It is true that $HCl O_4$ is stronger acid than $HCl O_3$. Any element tends to acquire maximum stable state therefore + VIII O. S can not be stable hence more reactivc.

162. Ans. (1) The electronic configuration of $_{24}Cr$ atom is $3d^5 4s^1$ hence it has six unpaired electrons are present. It is true that half filled s-orbital has greater stability.

163. Ans. (4) Stability complex depends up on the basic strength of ligands and formation of chelate ring . The ligand *en* (ethylene diamine) is stronger ligand than NH_3 and *en* forms chelate rings. Due to this reason $[Ni(en)_3)] Cl_2$ has high stability.

164. Ans. (3) Sb (III) comes under II group. The group reagent for this group is H_2S in HCl. These radicals are precipitated as their sulphide where as sulphide of other metals remain in the solution because of their high solubility product. HCl acts as a source of H^+ ion and thus decreases the concentration of S^{2-} ion (common ion effect). So the decreased concentration of S^{2-} is sufficient to precipitate the II group metals due to their low Ksp value.

165. Ans. (4) The magic number nuclei are most stable hence the order of stability as well as binding energy per nucleons are
$_2^4He > {}_4^9Be > {}_3^7Li$. Binding energy has nothing to do with the difference neutron and proton. It is related with packing fraction. Lower the packing fraction higher the value of binding energy per nucleons. The second most important thing is n/p ratio. The n/p ratio of these nuclei are $2 > 2.25 > 2.33$. Lower the value of n/p ratio binding energy per nucleons increases.

Be n : p = 2.25
Li n : p = 2.33
He n : p =2
He > Be > Li

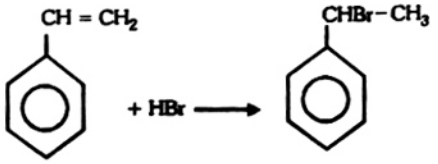
166. Ans. (2) It is true that Mg is not present in enamel of human teeth. Mg is an essential element for biological function like muscle contraction and blood coagulation.

167. Ans. (3) It is true that carboxypeptidase is an exopeptidase, there are a class of peptide cleaving enzymes which act on the terminal amino-acid residues. Carboxy peptidase acts on carboxyl end, and amino peptidase acts an amino end of the peptide.

168. Ans. (2) It is true that sucrose is non reducing sugar. It also contains glycosidic linkage. But it does not show reducing property due to absence of free or potential carbonyl group.

169. Ans. (3) It is true that isobutanal does not give iodoform test, It is due to absence of
$CH_3 - \overset{O}{\overset{\|}{C}} -$ group. Isobutanal contains one α–Hydrogen atom.

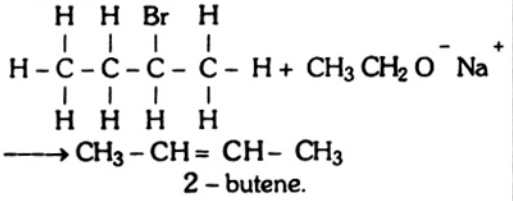
170 Ans. (3)



This reaction takes place as Markovnikovs addition. Alkyl radical is more stable than benzyl radical.

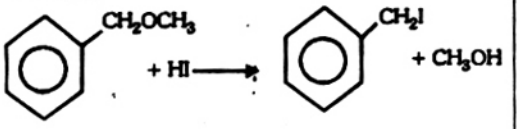
171. Ans. (3) The pKa value of acetic acid is less than phenol because acetic acid is stronger acid than phenol. Carboxylitate ion is more resonance stabilized than phenoxide ion.

172. Ans. (4)



According to Saytzeff rule, the major product is the most highly substituted alkene.

173. Ans (1)



Benzyl cation is more stable than methyl cation because methyl cation does not contain any electron withdrawing group but benzyl cation is resonance stabilized.

174. Ans. (1) It is true that molar entropy of vaporization of water is greater than that of ethanol. It is due to the fact that water is more polar than ethanol.

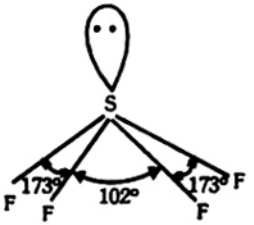
175. Ans. (1) It is true that aqueous gold in protective colloid is red in colour and this colour arises due to scattering of light by colloidal gold particle.

176. Ans. (3) If corrosion of Cu is taking place in acidic aqueous solution, it means electrochemical reaction taking place. The electrical work done means decrease in free energy. The value of free energy change will be negative.

177. Ans (4) AgCl will precipitate first because the ionic product of $Ag^+ Cl^-$ is greater than ionic product of $Ag^+ Br^-$.

178. Ans. (1) Molecular sieves are widely used as drying agents and as catalyst. Zeolites are capable for dehydrating alcohols because it is porous catalyst and easily accommodates hydrocarbons.

179. Ans. (3) All F—S—F bond is greater than 90° but less than 180° is true and clear from the structure



Lone pair-bond repulsion is stronger than bond pair-bond pair repulsion.

180. Ans. (3) The rate of effusion is proportional to the area of the orifice and mean velocity of the molecule and hence reciprocal of square root of the molecular weight of the gas. So the rate of oxygen will be smaller than nitrogen. The rate of effusion has nothing to do with the size of the molecule.

PHYSICS

181. Ans. (4) In dry cell a carbon and a zinc electrode is used. The solutions NH_4Cl and MnO_2 are prepared in the form of a paste. These paste is contained in a zinc container which works as the negative electrode. The carbon rod works as a the terminal. When the current is passed through the cell Cl^- ions combine with zinc and the NH_4^+ ion move towards the carbon electrode. Again NH_4^+ ion get separated into NH_3 and H^+. This H^+ reacts with MnO_2 and forms Mn_2O_3 and H_2O.

Since, the Electro Motive Force which is a force depends upon the rate of formation of the ions. It does not depend on the amount of material used. So, the e.m.f of a cry cell does not depends on its size. It depends only on the rate of formation of ions. So both the given assertion and reason is wrong.

182. Ans. (2) Actually there are three primary colours as Red, Green and Blue.

All the other colours are formed due to the combination of these primary colours and is called secondary colours. These colours are formed as follows :-

Red + Green = Yellow

Red + Blue = Magenta

Green +Blue = Cyan

Now according our assertion, the Red and Yellow is means Red + (Red + green). So the red becomes highly concentrated. So, it becomes dark.

Though the red colour scatters less, but it is not the reason of assertion.

183. Ans. (2) When pressure becomes low, the boiling point of water decreases.

In our case, the water of cooker was boiling and the pressure inside the cooker is greater than the atmospheric pressure. When we take out the vapour suddenly, then pressure inside the cooker decrases suddenly. And so the water starts boiling below the boiling point (i.e. below 100° C) .

This is also true that the boiling point of water at atmospheric temperature which is 100° C decreases when we add some impurities in the pure water.

So, we can conclude that assertion and reason both are correct but reason is not the current explanation of assertion.

184. Ans. (4) The true geographic north direction is same angle right to the actual compass needle.

The magnetic meridian of the earth is along the perpendicular to the axis of rotation of the earth.

So both assertion and reason are incorrect.

185.Ans (1)

186. Ans. (1) In a transistor there are three terminals :-

(i) Base (ii) Emitter (iii) Collector

The base should be thin to make the transistor stable. But it does not mean that the base should be very thin. If it becomes very thin, then a very small fluctuation of current can damage the transistor. In a stable transistor, the output current is continuous.

187. Ans. (1) The β– particle can not penetrate in our body. So it can not damage strong part of our body.

^{90}Sr can go to the human begins body through milk which can make harmful to the production of red blood corpuscules.

188. Ans. (1) In general, the different colours which we are seeing except the dispersion of light is due to the interference of light waves.

Now in case of morpho-butterfly, its wing having different pigments which reflects light at different angles. After the reflection of the light, it interferes and forms different beautiful -colours.

189. Ans. (1) The small colour dots can have different shapes. So the angular separation of adjacent dots changes with the distance from the painting. So when we move the painting colour changes.

190. Ans.(1) If the superconductor is placed in a magnetic field its super conducting behaviour disappears. There is nothing like the superconductor repels or attracts the magnet.

The superconductivity has been shown at very low temperature only.

191. Ans. (3) The fission is a process in which a heavy atom breaks into two or more parts. The mass of the parent nucleus is larger than the daughter nuclii. This difference in mass is converted into energy. So during a fission process some amount of energy is liberated

The energy released in this process is due to the mass defect, not due to the binding energy of parent and daughter nuclei.

So, assertion is true and reason is wrong.

192. Ans (4) Since the pressure inside the drop is larger by an amount

$$\Delta P = \frac{2S}{R}$$

Where S= surface tension
R = radius of drop.

Again $P = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$

$\therefore$ $F = P.A$

$$= \frac{2S}{R} \times A$$

$$= \frac{2S}{R} \times 4\pi R^2$$

$$F = 8\pi S.R$$

So, $\mathbf{F \propto R}$

Again $\Delta P = \frac{2S}{R} = \frac{2S \times 4\pi R}{4\pi R^2}$

$$= \frac{8\pi R}{A}$$

where $A = 4\pi R^2$ = Surface Area of sphere

$\Rightarrow$ $\mathbf{\Delta P \propto \frac{1}{A}}$

Thus we see that the deforming force is proportional to the radius of the drop and excess pressure inside the drop is inversely proportional to the surface area.

Both are wrong.

193. Ans. (2) Due to the increase of pressure the Boiling Point of liquid increases and the melting point decreases.

Again the density of Ice is more than the water, that why the ice is floating on the surface of water. This happens due to the open structure of the ice crystal. So that after melting the ice, it contracts in volume.

But the reason is not the exact explanation of assertion. Both the facts are independent facts.

194. Ans. (1) Heavy water is deuteron. Deuteron having one proton, one neutron in nucleus and an electron revolving round the nucleus. It is an isotope of hydrogen. Deuteron can slow down the fast moving particles when the particles passed through it . So it is used in the reactor as a moderator.

195. Ans. (4) There are two types of mechanical system (or frame of reference)

(1) Inertial Frame of Reference :-

When we study about a system moving with some uniform velocity or non-uniform velocity with respect to a fixed object is called inertial frame of reference. In inertial frame of reference, the Newton's laws of motion holds good.

(2) Non. Inertial Frame of Reference :-

In this frame of reference, we are having two bodies accelerating with each other. For an example let us see that a body is moving with an acceleration of 'a' w. r. t the fixed poles and trees besides the road. Again one another particle is just fired from that moving body having acceleration of 'a' with respect to that moving body. This type of system in which two bodies are moving with an acceleration with respect to each other is an example of non- inertial frame. The Newton's laws of motion does not hold good for non-inertial frame.

So that both the statements are wrong.

196. Ans. **(1) LASER** :- Light Amplification by Stimulated Emission of Radiation.

The laser beam is monochromatic, coherent and intense beam. He-Ne is a laser in which He is present in large amount and Ne in less. So the population inversion i.e. having metastable state is dominated by He.

Note:- Metastable State :-

The state of a system or body in which it appears to be in state equilibrium but if it disturbed can settle into a lower energy state.

197. Ans. (1) In common emitter configuration means the emitter is common in both the input and output. In this configuration the impedance is low as well as the emitter region is forward biased always.

Note:- Impedance is just like resistance.

198. Ans. (1) Any thermodynamical process can not retrace its path. This happens due to the fact that during the thermodynamical process, some of its energy wastes. When we retrace this process we can not get this wastage of en-

ergy. So in nature the thermodynamical process is irreversible due to dissipation effect.

So both the assertion and reason are correct and reason is correct explanation of assertion.

Note:- Dissipation means that the wastage of energy during the change of energy from one system to another .e.g heating of wire during flow of current, production of sound waves by a machine.

199. Ans. (1) When a ray having the wavelength in the range of the interatomic distance of the crystal. then the diffraction takes place by that ray. Generally, the interatomic distance in the crystal is of the order of 0.1 nm. And the wavelength of x-rays is 0.1 to 10 nm. So, the x-ray is giving diffraction pattern of crystalline solid

200. Ans. (4) Photoelectric effect is a phenomenon in which the photon comes on the surface of a metal and ejects the electrons. This ejected electron is called photoelectrons.

In this process we can easily say that a packet of energy is incident called photon (having energy *hυ)* falls on the surface of the metal and gives that energy to the electron. This electron gets excited and then if it gets sufficient energy it comes out from the surface. So, photoelectron emission shows the particle nature of photon.

The number of photoelectrons depend upon the intensity of light, not on the frequency of incident light

So both are wrong.