

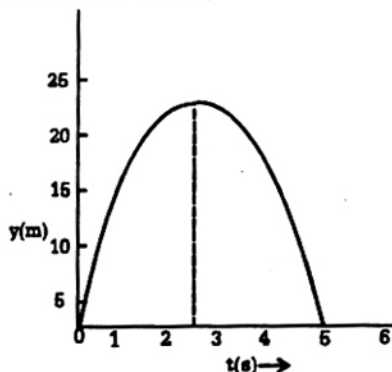
Max. Time : $3\frac{1}{2}$ hrs.

Max. Marks : 200

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

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

2. A ball is shot vertically upwards from the surface of a planet in a distant solar system. A plot of the y versus t for the ball is shown below,



The magnitude of the free fall acceleration on the planet is :-

- (1) 4 (2) 8 (3) 12 (4) 16
3. Down hill skiers ride the skis in an 'egg position'. They do so to :
- (1) Minimize effective cross sectional area.
(2) Minimize drag coefficient
(3) Reach high speed
(4) Reduce moment of inertia
4. A cricket bat is flipped in air. The centre of mass of the bat describes a :
- (1) Circular path
(2) Complicated trajectory
(3) Parabolic path (4) Straight line.

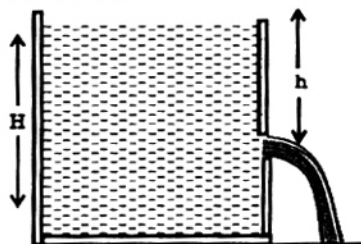
5. The escape velocity for a body of mass 1 kg from the earth's surface is 11.2 km/s. The escape velocity for a body of mass 100 kg would be :

- (1) 11.2×10^2 km/s (2) 112 km/s
(3) 11.2 km/s (4) 11.2×10^{-2} km/s

6. The scalar product of force (F) and the velocity (V) vectors represents:

- (1) Work (2) Energy
(3) Power (4) Impulse

7. A tank is filled with water to a height H. A hole is punched in one of the walls at a depth h below the water surface as shown below :



The distance from the base of the tank where the resulting stream strikes the floor is given by :

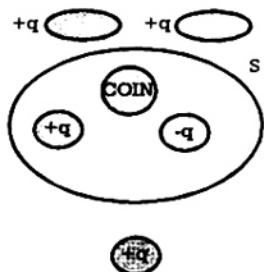
- (1) $\sqrt{h(H-h)}$ (2) $2\sqrt{h(H-h)}$
(3) $h\sqrt{\frac{(H-h)}{h}}$ (4) $H\sqrt{\frac{(H-h)}{H}}$

8. In cold season the lakes freeze from the top. Below this layer the water doesn't freeze and aquatic life survives. This happens because of :

- (1) Poor thermal conductivity of ice.
(2) The density of water is maximum at 4°C
(3). Heat convection does not take place in water

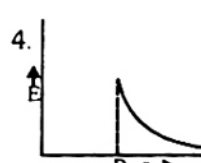
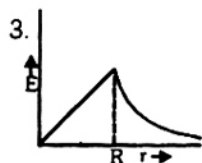
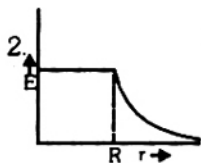
(4) Low latent heat of ice.

9. Five charged lumps of plastic and an electrically neutral coin are located as shown below



The cross section of a Gaussian surface (S) is indicated. The next flux through the surface is:

- (1) q/ϵ_0 (2) Zero
(3) $2q/\epsilon_0$ (4) $3q/\epsilon_0$
10. Which of the following graphs depicts the variation of electric field E with distance from the centre of a uniformly charged sphere of radius R made of a non-conducting material?

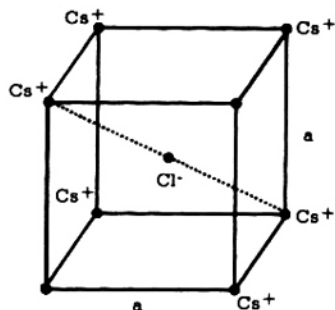


11. A neutron moving with a velocity v hits a stationary deuteron. The fraction of kinetic energy lost by the neutron in the collision is approximately:

(1) $2/3$ (2) $8/27$ (3) $8/9$ (4) $16/81$

12. In the basic CsCl crystal structure Cs^+ ions form the corners of a cube and a Cl^- ion is at the cube's centre. If one of the Cs^+ ions is missing, the magnitude of the net electrostatic force exerted on

the Cl^- ion by the remaining seven Cs^+ ions at the corners is:



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

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

13. The pollen from the flower is lifted by the honeybee:

(1) Mechanically (2) Electrically
(3) By suction (4) Sticking

14. In a Desk Jet printer the position of the drop on the paper is determined by the:

(1) Deflecting electric field
(2) Electric charge carried by the drop
(3) The speed of the jet
(4) Size of the jet

15. In a hydrogen atom the electron in a given orbit has total energy -1.5 eV . Its potential energy is:

(1) 1.5 eV (2) -15 eV
(3) -3.0 eV (4) 3.0 eV

16. An electron oscillating with a frequency of $3 \times 10^6 \text{ Hz}$ would generate:

(1) Radio waves (2) X-rays
(3) Ultraviolet rays (4) Microwaves

17. Optical communication provides:

(1) Very large bandwidth
(2) Loss-free transmission
(3) Faster communication

(4) Noise-free transmission

18. A laser directed into the patient's eye could fix detached retina. This is possible because the laser light :

- (1) Is monochromatic
- (2) Is coherent
- (3) Has small angular spread
- (3) Can be sharply focused

19. A disk-shaped magnet is levitated above a superconducting material that has been cooled by liquid nitrogen. This happens because a superconductor is :

- (1) Diamagnetic
- (2) Non magnetic
- (3) Paramagnetic
- (4) Antiferromagnetic

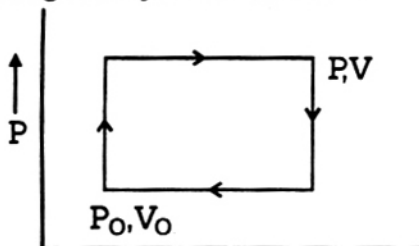
20. A corona around the moon is seen when we view it on a foggy or misty night. This due to :

- (1) Diffraction patterns of the airborne water droplets
- (2) Dispersion of light by airborne water droplets
- (3) Scattering of light by airborne water droplets
- (4) Formation of a diffused image of the moon

21. An astronaut, located in a space shuttle at an altitude of 1000 km, looking down on earth's surface can resolve objects having linear dimensions of the order of:

- (1) 50 m
- (2) 125 m
- (3) 200 m
- (4) 500 m

22. One mole of monatomic gas is taken through the cycle shown below:



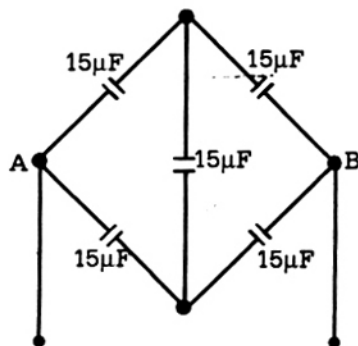
Assuming that $p = 2 p_0$ and $V = 2 V_0$, the efficiency of a Carnot engine working between the highest and the lowest temperatures that occur in the cycle is :

- (1) 25%
- (2) 50%

(3) 75%

(4) 100%

23. A network of capacitors is shown below:



The equivalent capacity of the network between the points A and B is :

- (1) $60 \mu\text{F}$
- (2) $30 \mu\text{F}$
- (3) $20 \mu\text{F}$
- (4) $15 \mu\text{F}$

24. The wavelength of sodium light in air is 5890 \AA . If the velocity of light in air is $3 \times 10^8 \text{ m s}^{-1}$, the wavelength of sodium light in glass (refractive index 1.6) would be closest to :

- (1) 5890 \AA
- (2) 3680 \AA
- (3) 9424 \AA
- (4) 15078 \AA

25. On passing through a slab, the intensity of sound gets reduced by 20%. On passing through two such slabs placed in contact with each other, the intensity of sound will get reduced by :

- (1) 20%
- (2) 36%
- (3) 40%
- (4) 50%

26. Two thin lenses, having focal lengths 20 cm and -40 cm, are placed in contact with each other. The focal length of this combination will be :

- (1) +20 cm
- (2) +40 cm
- (3) -20 cm
- (4) -40 cm

27. Yellow light is refracted through a glass prism placed in the minimum deviation position. The the:

- (1) Angle of incidence is smaller than the angle of emergence

- (2) Angle of incidence is greater than the angle of emergence.
 (3) Angle of incidence is equal to the angle of emergence.
 (4) The sum of the angles of incidence and emergence is equal to 90°
- 28. The force experienced by charged particle in a magnetic field is maximum when the particle :**
- (1) Moves in a direction parallel to the magnetic field
 (2) Moves in a direction perpendicular to the magnetic field
 (3) Is at rest
 (4) Moves in a direction making an angle of 45° with the direction of magnetic field
- 29. When an elastic material having Young's modulus of elasticity Y is subjected to a tensile stress σ , the elastic energy stored per unit volume of the material is :**
- (1) $\sigma/2Y$ (2) $\sigma Y/2$
 (3) $\sigma^2 Y/2$ (4) $\sigma^2/2Y$
- 30. Which of the following quantities remains invariant when a steady current flows in a metallic conductor of non-uniform cross section ?**
- (1) Current (2) Current density
 (3) Drift velocity of the charge carriers
 (4) Electric field
- 31. Which of the following acts as a reflector for radio frequency waves ?**
- (1) Upper layers of troposphere
 (2) Ionosphere (3) Mesosphere
 (4) Stratosphere
- 32. A surface when illuminated by green light emits photoelectrons but not by yellow light. Such a surface can also emit photoelectrons. If it is illuminated by :**
- (1) Red light (2) Infrared radiation
 (3) Blue light (4) Orange light
- 33. Siemens is the S.I. unit of**
- (1) Electrical conductivity
 (2) Electrical conductance
 (3) Electrical resistivity
 (4) Thermal conductivity
- 34. An inductor of inductance $1H$ offers the same impedance as that by a capacitor of capacitance $1\mu F$. This happens at a frequency of :**
- (1) 460 Hz (2) 159 Hz
 (3) 512 Hz (4) 1 kHz
- 35. Two gases having same pressure P and volume V are mixed at a temperature T . If the mixture is at a temperature T and occupies a volume V , the pressure of the mixture would then be :**
- (1) P (2) $2P$
 (3) $P/2$ (4) $3P$
- 36. A steel ball and a glass ball of the same size fall through a long column of a viscous liquid. The terminal velocities V_s and V_g of steel and glass balls are related as :**
- (1) $V_g = V_s$ (2) $V_s > V_g$
 (3) $V_g = 2V_s$ (4) $V_s = (2/9)V_g$
- 37. A black body, at a temperature of $77^\circ C$, radiates heat at a rate of $10\text{ cal cm}^{-2}\text{ s}^{-1}$. The rate at which this body would radiate heat in units of $\text{cal cm}^{-2}\text{ s}^{-1}$ at a temperature of $427^\circ C$ is closest to :**
- (1) 40 (2) 160
 (3) 200 (4) 400
- 38. Two waves of wavelengths 99 cm and 100 cm travelling with a speed of 396 ms^{-1} are made to interfere. The number of beats produced per second by them is :**
- (1) 1 (2) 2 (3) 4 (4) 8
- 39. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness $2\mu\text{m}$ and refractive index 1.5, is introduced in the path of the upper beam. The location of the central maximum will .**
- (1) Remain unshifted

- (2) Shift downward by nearly two fringes
(3) Shift upwards by nearly two fringes
(4) Shift downwards by 10 fringes
- 40. To a germanium sample, traces of gallium are added as impurity. The resulting sample would behave like :**
- (1) A conductor
(2) A p-type semi-conductor
(3) An n-type semi-conductor
(4) An insulator
- 41. Who is the Director General of Council of Scientific and Industrial Research (CSIR) :**
- (1) Dr. Raghunath A Mashelkar
(2) Dr. V.S. Ramamurthy
(3) Dr. Manju Sharma
(4) Dr. S.K. Ganguli
- 42. Bandhavgarh National Park is situated in:**
- (1) Madhya Pradesh (2) Orissa
(3) Rajasthan (4) Gujarat
- 43. Which of the great personalities is connected with the place called 'Paunar Ashram'.**
- (1) Mahatma Gandhi
(2) Baba Amte
(3) Sunder Lal Bahuguna
(4) Vinoba Bhave
- 44. The name 'Baden Powel' refers to :**
- (1) An Italian born Christian religious leader
(2) A German play writer
(3) A King of France
(4) Founder of Boy Scouts
- 45. Which of the following is the national animal of India :**
- (1) Cow (2) Horse
(3) Elephant (4) Tiger
- 46. Who wrote 'Godaan' ?**
- (1) Kalidas (2) Abul Fazal
(3) Prem Chand (4) Jai Shankar Prasad
- 47. Which of the following pair is incorrect?**
- (1) Richest deposits of aluminum - Kerala
- (2) Richest deposits for uranium - Malabar coast
(3) Richest deposits of lead - Udaipur (Raj.)
(4) Longest deposits of Coal - Raniganj
- 48. All of the following inventions were made in U.S.A., except "**
- (1) Microscope (2) Microphone
(3) Gramophone (4) Transistor
- 49. India's first scientific satellite Aryabhata was launched in :**
- (1) 1975 (2) 1979
(3) 1980 (4) 1983
- 50. Who was the first to reach the North Pole ?**
- (1) Robert Peary
(2) James Cook
(3) William Edmondson
(4) Charles Wilkes
- 51. 'Junta' Means :**
- (1) General Public
(2) Public opinion
(3) People's government
(4) A political group that secures power by force
- 52. St. Helena is associated with :**
- (1) Hitler (2) Maxmuller
(3) Musolinee (4) Napoleon
- 53. Ramon Magsaysay was the President of which country ?**
- (1) Indonesia (2) Philippines
(3) Thailand (4) Malaysia
- 54. Which of the following city/town has 'Char Minar' ?**
- (1) Delhi (2) Hyderabad
(3) Bangalore (4) Bhillai (Raipur)
- 55. Pittsburgh is a city in :**
- (1) UK (2) USA
(3) Russia (4) Germany
- 56. At which place did Gautam Buddha deliver his first sermon ?**
- (1) Lumbini (2) Sanchi
(3) Sarnath (4) Bodh Gaya

57. Who is the author of the book "We Indians" ?

- (1) Mulk Raj Anand
- (2) Nirad C Choudhary
- (3) Khushwant Singh
- (4) R.K. Narayan

58. With which of the following game the Davis Cup is associated with ?

- (1) Lawn Tennis (2) Badminton
- (3) Hockey (4) Basketball

59. Which of the following state is largest producer of sugarcane ?

- (1) Punjab (2) Haryana
- (3) Uttar Pradesh (4) Maharashtra

60. Where the Great Barrier Reef is located?

- (1) Queensland
- (2) New Siberian Islands
- (3) Greenland (4) Madagascar

61. A person is suffering from long standing constipation . It is likely that :

- (1) His intestinal bacteria will get killed by poisonous gases produced by accumulated feces.
- (2) He will suffer from piles
- (3) He will feel severe pain in the stomach due to accumulated feces
- (4) He will suffer from vitamin B deficiency as its absorption is inhibited

62. Night-blindness can be treated by :

- (1) Using corrective glasses with proper lenses
- (2) Including lot of green leafy vegetables and yellow fruits in the diet
- (3) Using eye drops containing β -carotene
- (4) Avoiding darkness

63. The heart sounds normally heard by a physician while holding a stethoscope onto the left side of the chest of the patient are due to :

- (1) Contraction of atrial chambers
- (2) Contraction of ventricular chambers
- (3) Closure of the atrioventricular valves
- (4) Relaxation of the semilunar valves

64. When an aeroplane takes off, some occupants, often feel pain in the region of ears. This is because of :

- (1) Rapid movement of fluid in semicircular canals
- (2) Blockage of Eustachian tubes
- (3) Rapid movements of otoliths in macula region of utricle and saccule
- (4) Increased amplitude of the vibrating tympanum due to very loud sound produced by the engines

65. A young boy has infantile penis, seminal vesicles and prostate. The condition can be improved by treating with :

- (1) An extract of pituitary glands
- (2) Growth hormone
- (3) Sildenafil nitrate (Viagra)
- (4) Testosterone

66. Which one of the following animals has a diaphragm and enucleated red blood cells ?

- (1) Whale (2) Crocodile
- (3) Sea horse (4) Shark

67. Integrated pest management (IPM) aims at:

- (1) 95% control of the pest
- (2) Complete control of pests
- (3) Keeping pest population below economic injury level
- (4) Drastically reducing cost of farming for poor farmers

68. Human skin has a keratinized and water impermeable layer of flattened cells . This is called stratum :

- (1) Lucidum (2) Corneum
- (3) Malpighi (4) Granulosum

69. Mutations :

- (1) Take place gradually and in small steps
- (2) Are all heritable and give rise to new species
- (3) Are subject to natural selection
- (4) Are random changes in base sequence of RNA

70. In rabbit, when a dilute solution of glucose reaches the small intestine, it is :

- (1) Absorbed rapidly by active transport with sodium ions
- (2) Absorbed by facilitated diffusion like fructose
- (3) Lost to outside with undigested food as its concentration is very low
- (4) Absorbed rapidly by active transport independent of sodium ions

71. Artificial respiration at the rate 10–15 times per minute is being given to a man saved from drowning. This is because :

- (1) The water in the respiratory passages is cleared fast at this rate
- (2) It is the normal rate of breathing
- (3) Choking is least at this rate
- (4) The lungs are ventilated best at this rate

72. Which one of the following is a matching pair of the kind of excretory organ and an animal ?

- (1) Urinary tubules – Scorpion
- (2) Nephridia – Frog
- (3) Malpighian tubules – House lizard
- (4) Green glands – Prawn

73. How can one keep a tadpole of frog unchanged in the same stage for a pretty long time ?

- (1) Maintain them on very little food
- (2) Provide them with a diet rich in proteins
- (3) Add lot of thyroxine to the aqueous medium in which they are kept
- (4) Provide them an antithyroid substance like thiourea

74. Crustaceans have :

- (1) Cephalothorax, one pair of antennae and chitinous exoskeleton
- (2) Cephalothorax and abdomen, two pairs of antennae and biramous appendages
- (3) Chitinous exoskeleton, biramous appendages and well developed lungs
- (4) Head and abdomen, one pair of antennae and nauplius larva

75. Nails and horns and the scales on the back of a scaly ant eater (pangolin) and the scales on the tail of rat, are :

- (1) Derivatives of keratinized epidermal material
- (2) Homologous organs
- (3) Analogous organs
- (4) Secretions from special skin glands

76. Mutualism is observed between :

- (1) Rat flea and rat
- (2) Sea anemone and Hermit crab
- (3) Zoochlorella and Hydra
- (4) Leaf butterfly and the twig on which it rests .

77. Which one of the following is the major atmospheric pollutant in big cities like Kolkata, Delhi , etc. ?

- (1) Benzene (C_6H_6)
- (2) Carbon dioxide (CO_2)
- (3) Oxides of nitrogen (NO_x)
- (4) Suspended particulate matter (SPM)

78. Which insecticide was manufactured in the Union Carbide Insecticide plant in Bhopal before it was shut down after the Bhopal tragedy ?

- (1) Carbofuran
- (2) Carbaryl
- (3) Methylisocyanide
- (4) Phosphene

79. The disease filariasis is transmitted through :

- (1) Physical contact between the patient and a healthy person
- (2) Droplet infection
- (3) Bite of sand fly
- (4) Bite of the Culex mosquito

80. Pasteurization of milk means that :

- (1) All bacteria are killed in it
- (2) The pathogenic bacteria , if present, are killed
- (3) Milk is enriched with vitamins
- (4) Milk casein is partially digested

81. The general body plan and the body symmetry are similar in :

- (1) Frog and locust
- (2) Sea horse and starfish
- (3) Annelids and sponges
- (4) Pigeon and liver fluke

82. Which one of the following is an example of biological control of pests ?

- (1) Use of transgenic plants resistant to the pests
- (2) Control of aphids by ladybird beetle
- (3) Use of sex attractants to control pests
- (4) Control of screw worm by release of sterile males

83. The reabsorption of calcium and magnesium ion in the kidney tubules is stimulated by a hormone secreted from :

- (1) Anterior pituitary (2) Posterior pituitary
- (3) Thyroid (4) Parathyroid

84. *Vallisneria*, *Nelumbo* (lotus) and *Typha*:

- (1) Are phytoplanktons
- (2) Are medicinal plants
- (3) Are aquatic rooted plants
- (4) Possess Kranz anatomy

85. At which stage of prophase of meiosis the homologous chromosomes get arranged in pairs :

- (1) Zygotene (2) Pachytene
- (3) Leptotene (4) Diplotene

86. The crossing of an organism with a double (homozygous) recessive in order to determine whether it is homozygous or heterozygous for a character under consideration is known as :

- (1) Back cross (2) Test cross
- (3) Reciprocal cross (4) Dihybrid cross

87. Dumb-bell shaped guard cells are found in :

- (1) Wheat (2) Bean
- (3) Ground nut (4) Sunflower

88. Which one of the following pairs refers to one and the same thing ?

- (1) Adrenal and Suprarenal
- (2) Centrosome and centriole
- (3) Notochord and vertebral column
- (4) Malpighian capsule and Bowman's capsule

89. A certain plant shown scattered vascular bundles in cross section of its stem.

Which other character can be expected in the same plant ?

- (1) Parallel venation
- (2) Pentamerous flowers
- (3) Dicotyledonous seeds
- (4) Tap root system

90. When a sunflower leaf is exposed to sunlight, the solar radiations first pass through its upper epidermis and then through :

- (1) Spongy parenchyma
- (2) Lower epidermis (3) Vascular bundles
- (4) Palisade parenchyma

91. The receptacle (thalamus) contributes to the main edible part in fruits like :

- (1) Apple and fig (2) Fig and pineapple
- (3) Mango and guava
- (4) Water melon and banana

92. In Blackmann's law of Limiting Factors the rate of photosynthesis continues to increase with the successive increase in the amounts of :

- (1) Carbon dioxide, light, temperature
- (2) Temperature, light, carbon dioxide
- (3) Light, temperature, carbon dioxide
- (4) Light, carbon dioxide, temperature

93. The plant growth regulators categorized as cytokinins :

- (1) Usually act in conjunction with auxins
- (2) Inhibit stem elongation
- (3) Accelerate abscission of leaves, flowers and fruits
- (4) Promote sprouting of potatoes

94. The rolling of leaves of many grasses in dry weather is an example of :

- (1) Tropic movements
- (2) Turgor movements
- (3) Nastic movements
- (4) Sleep movements

95. Vernalization is a phenomenon which concerns :

- (1) Low temperature requirement for flowering in plants

- (2) Migration of birds from their winter homes to summer habitats
- (3) Immunization of infants against the common infectious diseases
- (4) Entering of cold-blooded animals into an inactive state in winter

96. Which one of the following pairs consists of both recessive traits in *Pisum sativum* as studied by Mendel?

- (1) Dwarf plant and axial flower position
- (2) Constricted, pod shape and round seed shape
- (3) Green seed colour and terminal flower position
- (4) White flower and yellow seed colour

97. Which one of the following types of wheat is correctly matched with its diploid chromosome number?

- (1) *Triticum aestivum* -40
- (2) *Triticum durum* -32
- (3) *Triticum monococcum* -28
- (4) *Aegilops speltoides* -14

98. World No Tobacco Day is observed on:

- (1) May 31
- (2) June 6
- (3) April 22
- (4) October 2

99. The element located at the centre of the porphyrin ring in chlorophyll is:

- (1) Manganese
- (2) Magnesium
- (3) Molybdenum
- (4) Potassium

100. Which is the most abundant chemical element found in the entire living world?

- (1) Hydrogen
- (2) Oxygen
- (3) Carbon
- (4) Nitrogen

101. Molecular orbital having two nodal planes perpendicular to each other is:

- (1) π py
- (2) σ^*
- (3) π^* py
- (4) σ

102. The correct order of enthalpy of hydration is:

- (1) $V(II) > Cr(II) > Mn(II) > Ca(II)$
- (2) $Ca(II) > Mn(II) > Cr(II) > V(II)$
- (3) $Mn(II) > Cr(II) > V(II) > Ca(II)$
- (4) $Cr(II) > Mn(II) > Ca(II) > V(II)$

103. Cobalt complex CoL_6^{4-} (L is a uninegative and monodentate ligand) will show isomerism when L is:

- (1) Chloride
- (2) Cyanide
- (3) Nitrate
- (4) Thiocyanate

104. Triphenyl phosphine will be formed on reacting PCl_3 with:

- (1) C_6H_5MgCl
- (2) C_6H_6
- (3) C_6H_5OH
- (4) $C_6H_5N_2Cl$

105. Which of the following compound/ions does not have N—N bond?

- (1) N_2O_3
- (2) CN_2
- (3) N_2H_4
- (4) N_2O

106. The correct order of stability is:

- (1) $PbF_2 > SnF_2 > GeF_2$
- (2) $GeF_2 > PbF_2 > SnF_2$
- (3) $SnF_2 > PbF_2 > GeF_2$
- (4) $GeF_2 > SnF_2 > PbF_2$

107. In $Si_6O_{18}^{12-}$ anion total number of oxygen atoms, which are not shared is:

- (1) 3
- (2) 6
- (3) 9
- (4) 12

108. The magnetic moment (spin only value) is less than 4.0 B.M. for free ion:

- (1) Cr^{2+}
- (2) Fe^{3+}
- (3) Co^{3+}
- (4) Co^{2+}

109. Which of the following acts as a Lewis acid for Et_2O :

- (1) BF_3
- (2) NF_3
- (3) O
- (4) B_2O_3

110. Iodine oxidizes:

- (1) $NaHSO_3$
- (2) $NaHCO_3$
- (3) $NaHSO_4$
- (4) Na_2HPO_4

111. Ag^+ reacts with reagent X to form a precipitate, which dissolves in its excess readily X is:

- (1) KCl
- (2) KCN
- (3) NH_4SCN
- (4) NaN_3

112. $AlCl_3$ on reaction with excess of 15 M NaOH gives:

- (1) Al_2O_3 (2) $\text{Al}(\text{OH})_3$
 (3) AlO_2^- (4) $\text{AlO}(\text{OH})_2^-$

113. Which of the following reacts readily with SiO_2 to give SiF_4 ?

- (1) XeF_6 (2) NaF
 (3) C_2F_6 (4) CaF_2

114. Which of the following is correct order of ligand strength ?

- (1) $\text{CO} > \text{NH}_3 > \text{H}_2\text{O} > \text{I}^-$
 (2) $\text{CO} > \text{H}_2\text{O} > \text{NH}_2\text{I}^-$
 (3) $\text{NH}_3 > \text{H}_2\text{O} > \text{I}^- < \text{CO}$
 (4) $\text{CO} > \text{I}^- > \text{H}_2\text{O} > \text{NH}_3$

115. For reaction



between 850 and 1980 °C Kp values fit the equation $\log K_p = 7 - \frac{8500}{T}$, where

T is temperature in K. If the reaction is carried out in quiet air, the temperature for complete decomposition of CaCO_3 is nearly :

- (1) 941 °C (2) 1167 °C
 (3) 1214 °C (4) 1487 °C

116. the enthalpy change when 1 g of water is frozen at

0 °C ($\Delta H_{\text{fus}} = 1.435 \text{ kcal/mol}$) :

- (1) + 143.5 cal/g (2) +79.7 cal/g
 (3) -79.7 cal/g (4) -143.5 cal/g

117. For conversion of gaseous atomic chlorine to chlorine gas :

- (1) ΔH is negative and ΔS positive
 (2) ΔH is positive and ΔS is positive
 (3) ΔH is negative and ΔS negative
 (4) ΔH is positive and ΔS negative

118. The volume of 4 g of oxygen at STP is similar to that 'x' g of nitrogen . The 'x' is :

- (1) 2.1 g (2) 2.8 g
 (3) 3.5 g (4) 4.2 g

119. Half life of $^{90}_{38}\text{Si}$ is 20 years. If its sample has activity 8000 disintegration/min today. Activity (disintegration/min) after 80 years would be :

- (1) 500 (2) 1000
 (3) 2000 (4) 2500

120. The bond length is in the order :

- (1) $\text{CN}^- > \text{CN} > \text{CN}^+$
 (2) $\text{CN} > \text{CN}^+ > \text{CN}^-$
 (3) $\text{CN} > \text{CN}^- > \text{CN}^+$
 (4) $\text{CN}^+ > \text{CN} > \text{CN}^-$

121. Among the following the most reactive towards a $\text{S}_{\text{N}}1$ reaction is :

- (1) $(\text{CH}_3)_2\text{CH Br}$ (2) $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$
 (3) $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$
 (4) $\text{C}_2\text{H}_5\text{Br}$

122. Among the following the most reactive towards an electrophilic aromatic substitution is :

- (1) $\text{C}_6\text{H}_5\text{CH}_3$ (2) $\text{C}_6\text{H}_5\text{NO}_2$
 (3) $\text{C}_6\text{H}_5\text{Cl}$ (4) C_6H_6

123. Acetophenone can not easily be prepared from :

- (1) $\text{C}_6\text{H}_5\text{CH}=\text{CH}_2$ (2) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_3$
 (3) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_3$
 (4) $\text{C}_6\text{H}_5\text{COCH}_3$

124. Among the following pKa is the lowest for :

- (1) $\text{C}_6\text{H}_5\text{CH}_2\text{CO}_2\text{H}$
 (2) $\text{CH}_3\text{CO}_2\text{H}$
 (3) $p\text{-CH}_3\text{-C}_6\text{H}_4\text{CH}_2\text{CO}_2\text{H}$
 (4) $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$

125. The most reactive carbanion is :

- (1) $\text{C}_6\text{H}_5\text{CH}_2^-$ (2) CH_3CH_2^-
 (3) $^-\text{CH}(\text{CO}_2\text{CH}_3)_2$ (4) O_2NCH_2^-

126. Fehling solution is decolorized by :

- (1) CH_3COCH_3
 (2) $\text{CH}_3\text{CHOHCOCH}_2\text{OH}$
 (3) $\text{C}_6\text{H}_5\text{COCH}_3$

(4) $C_6H_5CO_2H$

127. Acetophenone can be converted into ethyl benzene by :

- (1) $Pd - C/H_2$ (2) Na/C_2H_5OH
(3) Zn/HCl (4) $NaBH_4$

128. Phenol on treatment with $CHCl_3/KOH$ followed by acidification gives :

- (1) Salicylaldehyde (2) Salicylic acid
(3) m-hydroxybenzaldehyde
(4) m-hydroxybenzoic acid

129. Acetic acid can be obtained by the reaction

- (1) $CH_4 + NaOH + CO_2$
(2) $CH_3MgX + CO_2$ (3) $CH_3Br + CO_2$
(4) $CH_3Br + HCO_2H$

130. α - Keratins have a :

- (1) α - Helical structure
(2) β - sheet structure
(3) Tertiary structure
(4) Quaternary structure

131. Aldol condensation is used for the preparation of :

- (1) α - Hydroxyaldehydes
(2) β - Hydroxyaldehydes
(3) γ - Hydroxyaldehydes
(4) α - Ketoaldehydes

132. $C_6H_5COCH_3$, can be converted into $C_6H_5CO_2K$ by :

- (1) KOH/I_2 (2) $K_2Cr_2O_7$
(3) $KOH - H_2O$ (4) $KMnO_4$

133. Hemoglobin contains :

- (1) Fe^{2+} (2) Fe^{3+} (3) Fe^{+1} (4) Fe^0

134. $HC \equiv CH$ can be obtained from $CH_2 = CHCl$ by :

- (1) $KOH - H_2O$ (2) $K_2CO_3 - H_2O$
(3) $CH_3CO_2Na - H_2O$
(4) $NaNH_2$

135. The reduction potentials of two half-cells are given below :

$Mg = 2e^- \leftarrow Mg(s), E^0 = -2.37V$

$Cu + 2e^- \leftarrow Cu(s), E^0 = +0.34V$

The standard EMF of the cell

$Mg / Mg^{2+} || Cu^{2+} / Cu$ is

- (1) $-2.03V$ (2) $1.36V$
(3) $2.71V$ (4) $2.03V$

136. The solubility of Ag_2CO_3 is S. The K_{sp} for the salt is given by :

- (1) $2S$ (2) S^2 (3) $4S^3$ (4) $2S^2$

137. For Haber process of ammonia synthesis the rate of reaction (assuming no side reaction) measured as

$\Delta[NH_3]/\Delta t$ is $2.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$.

The rate in terms of hydrogen concentration would be

- (1) $1.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
(2) $2.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
(3) $2.4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
(4) $3.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

138. A solution of $Cu(II)$ sulphate is electrolyzed between copper electrodes by a current of 10.0 A for 9650 seconds. Which of the following statements is correct ?

- (1) 0.5 mol Cu is deposited on anode
(2) 1.0 mol Cu is dissolved from cathode
(3) The concentration of $Cu(II)$ remains unchanged in solution
(4) 0.5 mol of Cu is dissolved from cathode

139. For the reaction of acetic anhydride with a large excess of ethyl alcohol the order of reaction is :

- (1) 1 (2) 1.5 (3) 2 (4) 2.5

140. The density of crystalline $CsCl$ is 4 g/cm^3 (At wt of Cs 132.9). The volume (in cm^3) effectively occupied by a single $CsCl$ ion pair in the crystal is nearly .

- (1) 7×10^{-20} (2) 7×10^{-23}
(3) 8×10^{-20} (4) 8×10^{-23}

ASSERTION AND REASONING TYPE QUESTIONS

§ In the following question (141 – 200), a statement of assertion (1) is followed by a statement of reasoning R

- If both Assertion and Reason are true and the reason is the correct explanation of the Assertion, the mark 1.
- If both Assertion and 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 and Reason are false statements, then mark 4.

Assertion

Reason

- | | |
|--|---|
| 141. Next of CNG the unleaded petrol is safer as an automobile fuel | Inhaled lead gets absorbed in the body and is known to hamper haemoglobin formation |
| 142. A patient with kidney disorder needs to undergo dialysis at regular intervals | During dialysis blood separated by selectively permeable membrane moves in the opposite direction to dialyzing fluid containing small solutes and mineral ions but no excretory products |
| 143. Haemophilia is a genetic disorder generally found in males | Haemophilia is a sex-linked trait and the gene for haemophilia is located on the Y chromosome |
| 144. Meristem is located at all the growing points in a plant | Meristematic cells are highly specialized, with lignified cell wall to provide support. |
| 145. Complete oxidation of one molecule of glucose yields 28 molecules of ATP | Incomplete oxidation of glucose in muscle cells during active exercise leads to a build up of ethyl alcohol |
| 146. Our body contains separate T-cells for every antigen the body encounters | Each T-cell recognizes a specific antigen |
| 147. Heart pace maker is a life -saving device when the normal heart rate of 72-80 drops to 30-40 due to disease or some other cause | The pace -maker electrically stimulates the contractile heart walls. |
| 148. Copper -T is an effective contraceptive device in human females | Copper -T prevents passage of sperms from vagina upwards into the Fallopian tubes. |
| 149. Sowing a legume crop between two successive cereal crops in the same field improves the total yield | Legumes harbour nitrogen fixing bacterium <i>Rhizobium</i> in their root nodules |
| 150. The immediate ancestor of present day humans was <i>Australopithecus</i> | The fossils of <i>Australopithecus</i> were discovered from Australia, and its cranial capacity was $1150 - 1300 \text{ cm}^3$ which is very close to that of humans $1400-1450 \text{ cm}^3$ |

151. DDT has now become almost ineffective against mosquitoes
 152. No two species within a given community can have exactly the same niche
 153. The territorial boundaries of certain animals are marked by urination (dogs, tigers) or defaecation .
 154. In India the human population is currently undergoing the lag phase
 155. Heartwood is more durable and resistant to microorganisms and insects than sapwood .
 156. Six turns of Calvin cycle result in the production of one molecule of glucose ($C_6H_{12}O_6$)
 157. Plants growing in soil poor in iron nutrient tend to show chlorosis.
 158. Asiatic lion and the Indian tiger are camouflaged in their respective habitats
 159. One application of genetic engineering is the production of human insulin by microbes
 160. Phenylketonuria is an inborn error of metabolism
 161. Bond length in NO^+ is 0.09 \AA greater than that of NO
 162. Presence of sodium and calcium both make water hard
 163. H_2S is a good reducing agent whereas H_2SO_4 (conc) is an oxidizing agent
 164. H_2 and N_2 molecules have same kinetic energy at $35^\circ C$
 165. In solution of $PhMgBr$ made in dry Et_2O the coordinated number of Mg is four
 166. A solution of NaCl containing its 5.9 g in 1 kg water does not have freezing point $-0.189^\circ C$ ($K_f = 1.86^\circ C/m$)
 167. Enthalpy change for a process with no work other than expansion is equal to the heat added at constant pressure .
- Introduction of DDT brought a change in the gene frequency with a shift from DDT sensitive to DDT resistant mosquitoes
- The habitat of a species together with the functions forms its niche
- Urine and faeces of such animals contain chemicals which serve as pheromones
- A major section of Indian population is still below poverty line
- Heartwood contains organic compounds like oil, aromatic substances, gums, resins, tannins etc.
- Three molecules of ribulose 1,5-bisphosphate (RuBP) react with three molecules of carbon dioxide to produce six carbon intermediates
- Iron is an important constituent of the pigment chlorophyll.
- Gir forests are deficient of tall grasses whereas Corbett National Park is full of these
- Gene for production of human insulin can be transferred to *Escherichia coli* by recombinant DNA technique
- Phenylalanine is not converted into Alanine in individuals suffering from this.
- NO has two electrons in π^* orbitals
- From soap sodium and calcium stearate are precipitated in hard water
- H_2SO_4 is stronger electrolyte than H_2S
- Kinetic energy does not depend on temperature
- Mg is coordinated by four Et_2O molecules
- NaCl is a strong electrolyte ionizing completely in water
- For such an expansion $\Delta E = q - P\Delta V$

- | | |
|---|--|
| 168. Tungsten is used as filaments in light bulbs | It has very high electrical resistance |
| 169. Diamond does not conduct electricity | It has only σ electrons |
| 170. pH of 10^{-9} HCl is not 9 | The dissociation of water also gives H^+ |
| 171. Addition of excess aqueous ammonia (strong) to a solution of Cu^{2+} ions gives an intense blue colour | Cu^{2+} first forms a blue coloured $Cu(OH)_2$ |
| 172. Direct halogenation of alkanes is a good method for the preparation of alkyl halides | This procedure gives a single product |
| 173. Styrene can be oxidized by peroxybenzoic acid to give styrene oxide | Peroxybenzoic acid polarizes the double bond of styrene |
| 174. Isobutyl bromide in ethanol gives t-butyl ethyl ether | The reaction follows S_N1 mechanism |
| 175. <i>Trans</i> dialkyl ethylenes are more stable than <i>cis</i> -dialkyl ethylenes | <i>Cis</i> -dialkyl ethylenes have more dipole moment |
| 176. Aniline does not undergo Friedel -Crafts alkylation | NH_2 group reacts with alkyl halides |
| 177. Fructose is a reducing sugar | Fructose has a keto group |
| 178. A solution of alanine is nearly neutral | Alanine has a Zwitterionic structure |
| 179. 2-Bromobutane on treatment with alcoholic KOH gives 2-butene | Secondary hydrogen is more acidic than primary hydrogen |
| 180. Ethyl formate can give iodoform test at higher temperature | It does not have α -hydrogen |
| 181. Electric current, although having both magnitude and direction, is not a vector quantity. | Electric current does not obey the laws of vector addition |
| 182. A well-cut diamond shines brilliantly | It happens because of total internal reflection |
| 183. Warning signals installed at the top of tall buildings and monuments employ red light | Human eye is most sensitive to red colour |
| 184. A rod of flint glass, when immersed in carbon disulphide ???? | The refractive indices of flint glass and carbon disulphide are equal |
| 185. We always see the same 'side' of the moon | Sunlight is not reflected by the other side of the moon |
| 186. SONAR is employed in detection and location of objects under deep water | SONAR makes use of reflection of ultrasonic waves |
| 187. An ice skater can slide over ice smoothly if the skate blades are sharp | Melting point of ice decreases with increase in pressure |
| 188. On the sea shore, cool breeze flows in the evening | Convection currents are set up from sea to the land since land cools slower than water |

190. Bats navigate and search out prey by emitting and then detecting reflections of ultrasonic waves
 191. When you look at a clear blue sky or a featureless background, tiny specks and hair like structure are seen floating in your view. These are called floaters
 192. An electron microscope permits finer details of tiny structures
 193. X-ray diffraction is powerful tool for studying the arrangement of atoms in crystals
 194. Bees use sky light in navigating to and from their hives
 195. A giant hornet *Vespa Mondorina* preys on Japanese bees. However, if one of the hornets attempts to invade a beehive, several hundred bees quickly form a compact ball around the hornet to stop it. After about 20 min. the hornet is dead although the bees do not sting, bite, crush or suffocate it.
 196. Certain things happen in a certain sequence and could never happen on their own in a reverse sequence . An accidentally dropped egg splatters in a cup. The reverse process would never happen .
 197. Power transmission is done at very high voltages (1100kV)
 198. A Basilisk lizard can run across the top of a water surface
 199. The stream of water emerging from a water tap 'necks' down as it falls
 200. Earthquakes cause vast devastation. Sometimes short and tall structures remain unaffected while the medium height structures fall.
- Relative motion between the source and observer causes a change in the frequency of the sound wave as heard by the observer.
- Tiny deposits in the vitreous humor cause diffraction of light
- An electron microscope has high magnifying power
- The regular arrangement of atoms in a crystal constitutes a three dimensional diffraction grating
- Sky light is partially polarized
- The bees raise their body temperature from 35°C to 45°C , which is lethal to the hornet.
- The entropy of a system always increases
- Energy dissipation in transmission line is lower at higher voltages
- Water does not stick to its legs
- The volume flow rate at different levels is same
- The natural frequency of the medium structures coincides with the frequency of the seismic wave .

ANSWERS

1.(2) 2.(1) 3.(2) 4.(3) 5.(3) 6.(3) 7.(2) 8.(2) 9.(2) 10.(4) 11.(1) 12.(1)
13.(3) 14.(2) 15.(3) 16.(3) 17.(1) 18.(4) 19.(1) 20.(2) 21.(1) 22.(1)
23.(4) 24.(2) 25.(1) 26.(3) 27.(3) 28.(2) 29.(4) 30.(1) 31.(1) 32.(3)
33.(2) 34.(4) 35.(2) 36.(2) 37.(2) 38.(2) 29.(3) 40.(2) 41.(1) 42.(1)
43.(2) 44.(4) 45.(4) 46.(3) 47.(1) 48.(1) 49.(1) 50.(4) 52.(4) 53.(4)
53.(2) 54.(2) 55.(2) 56.(3) 57.(3) 58.(1) 59.(3) 60.(1) 61.(4) 62.(2)
63.(4) 64.(3) 65.(4) 66.(1) 67.(3) 68.(2) 69.(3) 70.(1) 71.(d) 72.(4)
73.(4) 74.(2) 75.(1) 76.(2) 77.(4) 78.(3) 79.(4) 80.(2) 81.(1) 82.(2)
83.(4) 84.(3) 85.(1) 86.(2) 87.(4) 88.(1) 89.(1) 90.(4) 91.(1) 92.(1)
93.(1) 94.(2) 95.(1) 96.(3) 97.(4) 98.(2) 99.(2) 100.(3) 101.(3) 102.(3)
103.(4) 104.(1) 105.(2) 106.(1) 107.(4) 108.(4) 109.(1) 110.(1) 111.(2)
112.(2) 113.(1) 114.(2) 115.(1) 116.(3) 117.(3) 118.(3) 119.(1) 120.(1)
121.(1) 122.(1) 123.(3) 124.(1) 125.(2) 126.(4) 127.(3) 128.(1) 129.(2)
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157.(4) 158.(1) 159.(1) 160.(3) 161.(4) 162.(4) 163.(2) 164.(3) 165.(4)
166.(1) 167.(1) 168.(2) 169.(1) 170.(1) 171.(2) 172.(3) 173.(1) 174.(4)
175.(2) 176.(1) 177.(2) 178.(1) 179.(2) 180.(4) 181.(1) 182.(1) 183.(1)
184.(1) 185.(3) 186.(2) 187.(2) 188.(3) 189.(1) 190.(1) 191.(1) 192.(1)
193.(1) 194.(3) 195.(3) 196.(4) 197.(3) 198.(3) 199.(1) 200.(1)

EXPLANATIONS

1. (2)

Since

$$E = L \frac{dl}{dt}$$

$$\therefore L = E \frac{dt}{dl}$$

and

$$E = \frac{W}{qt} = \frac{ML^2T^{-2}}{A}$$

$$L = ML^2T^{-2} \times \frac{T}{A \times AT}$$

$$= ML^2T^{-2} \times A^{-2}$$

2. (1)

Here distance = 25m

time = 2.5 sec

$$v = \frac{25}{2.5} = \frac{250}{25} = 10 \text{ m/s}$$

Now change in velocity

$$= 10 - (-10) = 10 + 10 = 20 \text{ m/s}$$

During this change in velocity the time taken is 5 sec

$$\text{So } \text{acc}^n = \frac{20}{5} = 4 \text{ m/s}^2$$

3(2) To minimize the drag coefficient

4 (3) Parabolic path,

Actually the bat can rotate. But the c.m. will follow a simple parabolic path

5. (3) Since the escape velocity is as

$$V_e = \sqrt{2gR_e}$$

where $g \approx 10 \text{ m/s}^2 = \text{constant}$

$R_e = \text{const.}$

\therefore And so V_e does not depend on the mass of the projectile

6(3)

Since

$$W = F \times s$$

and

$$P = \frac{W}{t} = \frac{F \times s}{t} = F \times \frac{s}{t}$$

since

$$\frac{s}{t} = v$$

\therefore

$$P = F \times \left(\frac{s}{t} \right)$$

$$= F \times V$$

7(2)

From the Torricelli's theorem we have

$$v = \sqrt{2gh}$$

Where $v =$ Velocity of the following liquid
and $h =$ height of the liquid column above the orifice

And if $h =$ height of the orifice from the bot-

tom, then $h' = ut + \frac{1}{2}gt^2$

$$= \frac{1}{2}gt^2$$

$$\Rightarrow h' = \frac{1}{2}gt^2$$

$$\therefore t = \frac{\sqrt{2h'}}{g}$$

$$\Rightarrow t^2 = \frac{2h'}{g}$$

Where $t =$ time of fall of liquid. So the range of falling

$$R = v \times t$$

$$= \sqrt{2gh} \times \sqrt{\frac{2h'}{g}}$$

$$= \sqrt{2 \times 2hh'}$$

$$= 2\sqrt{hh'}$$

Here

$$h' = (H-h)$$

and

$$h = h$$

\therefore

$$R = 2\sqrt{h(H-h)}$$

8. (2) Because the density of water is maximum at 4°C . So the ice floats on the surface and below the ice water is already present

9.(2)

According to G, law,

$$\Phi = \oint \vec{E} \cdot d\vec{s}$$

Here

$$d\vec{s} = q - q = 0$$

\therefore

$$\Phi = \oint \vec{E} \cdot d\vec{s} = \int 0 \cdot \vec{E} = 0$$

(Note: the charge outside the closed surface does not contribute at all)

10(4)

$$\text{since } E = \frac{Q}{4\pi\epsilon_0 r^2}$$

So as r increases, E decreases continuously

11(1)

Let the K.E. of neutron is

$$\frac{1}{2}m_n v^2$$

The deuteron has one proton (mass M_p) and one neutron (mass M_n)

This K.E. of a coming neutron is shared by all the three particles as the coming neutron, proton and neutron.

Let mass of proton and neutron are the same then the K.E. of one particle will become

$$\frac{1}{2}mv^2 \times \frac{1}{3} = mV^2$$

So the K.E. of the incident neutron = $\frac{1}{6}mv^2$

$$\text{change in K.E.} = \frac{1}{2}mv^2 - \frac{1}{6}mv^2$$

$$= \frac{3mv^2 - mv^2}{6} = \frac{2mv^2}{6} = \frac{1}{3}mv^2$$

$$\text{Fraction change} = \frac{\frac{1}{3}mv^2}{\frac{1}{2}mv^2} = \frac{1}{3}mv^2 \times \frac{2}{mv^2} = \frac{2}{3}$$

12.(1) All the forces between Cl^- and Cs^+ are opposite to each other. So they cancel each other according to the vector additions of forces.

Only one force between Cl^- and Cs^+ will exist from where the Cs^+ is missing. Hence the Cs^+ which is just opposite to the missing Cs^+ will act a force. (This does not have any force to get cancelled)

The distance between Cs^+ and Cl^- is $\frac{\sqrt{3}}{2}a$

\therefore The force between Cs^+ and Cl^- is

$$= \frac{1}{4\pi\epsilon_0} \frac{e^2}{\left(\frac{\sqrt{3}}{2}a\right)^2}$$

$$= \frac{1}{4\pi\epsilon_0} \times \left(\frac{e^2 \times 4}{3a^2} \right)$$

13 (3) By suction

14. (2) Because the electric charge carried by the drop.

15 (3) Since P.E. = double the total energy

$$= \frac{-1}{4\pi\epsilon_0} \frac{q}{r}$$

$$\text{Total energy} = -\frac{1}{4\pi\epsilon_0} \times \frac{q}{2r}$$

So, the P.E. = $2 \times (-1.5\text{eV}) = -3\text{eV}$

16. (3)

$$\text{Since } v = 3 \times 10^{16} \text{H}_2$$

$$\lambda = \frac{c}{v} = \frac{3 \times 10^8}{3 \times 10^{16}}$$

$$= 1 \times 10^{-8}$$

This wavelength comes in the range of ultra-violet rays.

17. (1) Due to the very large band width

18 (4) Because the laser beam can be sharply focussed.

19. (1) Actually the superconductors are made of the perfectly diamagnetic material. So the χ value of superconductor is -1

20 (2) This happens due to the dispersion of light. The light dispersed due to the water droplets.

$$21. (1) \text{ Since } h = \frac{0.61 \times \lambda}{\mu \sin \theta}$$

$$\text{Here } \sin \theta = \frac{1}{1000 \text{ km}}$$

$$= \frac{1}{1000 \times 10^3} = \frac{1}{10^6} = 10^{-6}$$

$$\mu = 0.044, \lambda = 5000 \text{ nm (say)}$$

(because the visible light has this range)

$$\therefore h = \frac{0.61 \times 5000 \times 10^{-9}}{0.044 \times 10^{-6}}$$

$$\approx 69 \text{ m}$$

So the answer lies nearest to this value is only 50m. So Ans (1)

22. (1)

Since $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$\Rightarrow \frac{T_2}{T_1} = \frac{P_2 V_2}{P_1 V_1}$

Here $P_1 = P_0, P_2 = 2P_0$
 $V_1 = V_0, V_2 = 2V_0$

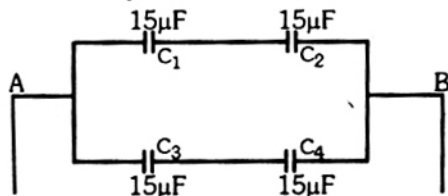
$\therefore \frac{T_2}{T_1} = \frac{2P_0 \times 2V_0}{P_0 V_0} = 4$

$\therefore T_2 = 4 \times T_1$

$\eta = \frac{T_1}{4T_1} \times 100 = 25\%$

23. (4)

There will be no charge on the middle capacitor. So the equivalent circuit is as



Since C_1 and C_2 are in series. So, equivalent

capacitance $C = \frac{C_1 C_2}{C_1 + C_2} = \frac{15 \times 15}{30}$
 $= \frac{15}{2} \mu F$

Similarly equivalent capacitance of C_3 and C_4

is $\frac{15}{2} \mu F$

Again these two are in parallel, so, the capacitance of the given circuit is

$C = \frac{15}{2} + \frac{15}{2} = 15 \mu F$

24. (2)

$\mu = \frac{\text{Wavelength of light in air } (\lambda_0)}{\text{wavelength of light in medium } (\lambda)}$

$\Rightarrow \mu = \frac{\lambda_0}{\lambda}$

$\therefore \lambda = \frac{\lambda_0}{\mu}$

$= \frac{5890}{1.6} = 3681.25 \text{ \AA} \approx 3680 \text{ \AA}$

25. (1) When they are in contact the reduction is the same.

26. (3)

$f = f_1 + f_2$

$f_1 = 20 \text{ cm}, f_2 = -40 \text{ cm}$

$f = 20 - 40 = -20 \text{ cm}$

27. (3) This is the condition of minimum deviation, $i=r$

28. (2) From L, force law we know that

$\therefore F = q(v \times B)$
 $= qvB \sin \theta$

And $\sin \theta$ will be maximum when $\theta = 90^\circ$.

So the angle between v and B will be 90°

29. (4)

Since elastic energy = E

$E = \frac{1}{2} \times \text{stress} \times \text{strain} \times \text{Volume}$

So, energy per unit volume

$E = \frac{1}{2} \times \text{stress} \times \text{strain}$

since $\gamma = \frac{\text{stress}}{\text{strain}}$

$\Rightarrow \text{strain} = \frac{\text{stress}}{\gamma}$

$= \frac{\sigma}{\gamma}$

$E = \frac{1}{2} \times \sigma \times \frac{\sigma}{\gamma} = \frac{1}{2} \frac{\sigma^2}{\gamma}$

30. (1)

(1) Current (I) = $\frac{dQ}{dt}$

(2) Current density = $\frac{I}{\text{C.S.A.}}$

\Rightarrow it depends on area

(3) Drift velocity = $\frac{I}{NeA}$

\Rightarrow it depends on area

(4) Electric field $\frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$

⇒ it depends on area

31. (1) Upper layer of the troposphere

32. (3)

R → smallest frequency

O

Y

G

B

I

V → Largest frequency

The energy of coming yellow light is less than the energy of green light. So by the yellow light the electrons having some threshold potential can not cross that potential. The light having greater energy than the yellow are violet, indigo and blue. Again the infrared light are having less energy than red light.

So the answer is (3) i.e. Blue light

33. (2) It is the S.I. unit of electrical conductivity equal to a conductance of one ohm⁻¹

34 (4) Impedance of inductor

$$Z_L = \omega L$$

$$\text{Impedance of capacitor } Z_C = \frac{1}{\omega C}$$

According to question

$$\omega L = \frac{1}{\omega C}$$

$$\Rightarrow \omega^2 L C = 1$$

$$\Rightarrow \omega^2 = \frac{1}{L C}$$

$$= \frac{1}{1 \times 1 \times 10^{-6}} = 10^6$$

$$\therefore \omega = 10^3 = 1 \text{ kHz}$$

So answer (4)

35. (2)

$$\text{Since } \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\text{Here } P_1 = P, V_1 = V + V = 2V; T_1 = T$$

$$P_2 = ?, V_2 = V; T_2 = T$$

$$\therefore \frac{P \times 2V}{T} = \frac{P_2 \times V}{T}$$

$$\Rightarrow P_2 = \frac{P \times 2V \times T}{V \times T}$$

So the answer is 2P.

36. (2)

Since terminal velocity is directly proportional to the density of the material i.e. $V_{\text{terminal}} \propto \rho$.

Since density of steel is greater than the density of glass. So the terminal velocity of steel is greater than the terminal velocity of glass.

$$\text{i.e. } V_s > V_g$$

37 (2)

Since the black body radiation formula is as

$$u = \sigma T^4$$

$$\text{Let } u_1 = \sigma(T_1^4)$$

$$= \sigma(273 + 77) = \sigma(350)^4$$

$$u_2 = \sigma(T_2^4) = \sigma(273 + 427)$$

$$= \sigma(700)^4$$

$$\therefore \frac{u_1}{u_2} = \frac{\sigma(350)^4}{\sigma(700)^4}$$

$$= \frac{1}{2 \times 2 \times 2 \times 2} = \frac{1}{16}$$

$$\therefore u_2 = 16 \times u_1$$

$$\text{and } u_1 = 10 \text{ cal cm}^{-2} \text{ s}^{-1}$$

$$\therefore u_2 = 16 \times 10 = 160 \text{ cal cm}^{-2} \text{ s}^{-1}$$

38. (2)

$$\text{Since } \lambda_1 = 99 \text{ cm} = 99 \times 10^{-2} \text{ m}$$

$$\therefore v_1 = \frac{396}{99 \times 10^{-2}} = 400 \text{ Hz}$$

$$\lambda_2 = 100 \text{ cm} = 100 \times 10^{-2} \text{ m}$$

$$v_2 = \frac{396}{100 \times 10^{-2}} = 396 \text{ Hz}$$

So the average frequency

$$= \frac{396 + 400}{2} = 398$$

So the frequency of beats

$$= \frac{396 + 400}{398} = 2$$

$$\begin{aligned}
 39.(3) \quad \lambda &= 500 \times 10^{-9} \text{ m} \\
 \mu &= 1.5, t = \text{thickness} \\
 &= 2 \mu\text{m} = 2 \times 10^{-6}
 \end{aligned}$$

Since we know that

$$\begin{aligned}
 (\mu-1)t &= n\lambda \\
 \Rightarrow (1.5-1) \times 2 \times 10^{-6} \\
 &= n \times 500 \times 10^{-9} \\
 \therefore n &= \frac{0.5 \times 2 \times 10^{-6}}{500 \times 10^{-9}} \\
 &= \frac{1 \times 10^{-6}}{500 \times 10^{-9}} = 2
 \end{aligned}$$

So that the central maximum will shift upwards by nearly two fringes

40. (2) Since gallium has 3 valency. When it is added to a semi-conductor then it will work as a p-type semi-conductor

61.(4) Will certainly suffer from vitamin B deficiency as its absorption is decreased. Constipation does not allow vitamin B to get absorbed

62.(2) Night blindness occurs due to the deficiency of vit. A (Retinol). Symptoms are dry skin, cornea becomes dry and mucous membranes degenerate and poor night vision. Vitamin A is essential for the formation of the visual pigment rhodopsin, which aids night vision. The sources of vit. A are cod liver oil, milk, carrots, spinach, etc.

63.(4) The first round in each cycle of heart beat is a low pitched "lub" caused by the closing of the bicuspid and tricuspid valves (atrioventricular valves). A little later one hears a higher pitch "dub", due to the closing of the pulmonary and aortic semilunar valves at the beginning of ventricular diastole. This higher-pitch sound is the sound physician normally heard by stethoscope.

64.(3) At high altitude rapid movement of otoliths in macula region exerts pressure on its wall. Due to this some people feel pain in the ear and some only feel heaviness in the ear region.

65.(4) Testosterone stimulates development of secondary sex characteristics in males and growth spurt at puberty.

66.(1) Whale is a mammal possessing diaphragm and enucleated red blood cells. All mammals possess enucleated RBCs except camel

67.(3) Integrated pest management (IPM) is an ecologically based pest-control strategy that relies on natural mortality factors, such as natural enemies, weather, cultural control methods, and carefully applied doses of pesticides.

68.(2) The layer of dead keratinised cells is called stratum corneum. Keratin is scleroprotein. Outer cells are regularly peeled off.

69.(3) Mutation is a permanent change in the cell's DNA. It includes changes in nucleotide sequence, alteration of gene position, gene loss or duplication and insertion of foreign sequences. If mutation occurs in somatic cells, they are not heritable but if occurs in germ cells they are heritable. They are subject to natural selections for the origin of new species.

70.(1) Active transport is the pumping of individual ions or other molecules across a cellular membrane from a region of lower concentration to a region of higher concentration (that is, against a concentration gradient). This transport process requires energy, which is supplied by the expenditure of ATP. Sodium ions coupled with glucose is transported inside the cell.

71.(4) The lungs collapse during drowning. It is ventilated best at this rate

72.(4) In prawn, excretory organ is a pair of green glands. Malpighian tubules are excretory organ in scorpion. In frogs and lizards, excretory organ is kidney.

73.(4) The hormone thyroxine is needed for complete metamorphosis in frog. It helps in absorption of tail in tadpole during the last stage of metamorphosis. Providing an antithyroid substance or removing thyroid can keep a tadpole unchanged to frog.

- 74.(2) Crustaceans have cephalothorax, abdomen, two pairs of antennae and biramous appendages.
- 75.(1) Nails and horns and the scales on the back of a scaly ant eater (pangolin) and the scales on the tail of the rat are all derivatives of keratinized epidermal material.
- 76.(2) Mutualism is the living together of two or more organisms in a symbiotic association in which both members are benefited. It is observed in sea anemone and hermit crab. Hermit crab lives inside empty shell and sea anemone attached on shell. So it is transported wherever the hermit crab goes and hermit crab gets scraps of food captured by sea anemone. So both are benefited.
- 77.(4) Major pollutants like SO_2 , NO_2 and particulate matter in which the SPM (suspended particulate matter) in Kolkata or Delhi's air exceed the permitted levels.
- 78.(3) Methyl isocyanide gas was responsible for the Bhopal gas tragedy in 1984.
- 79.(4) Filarial worms (*Wuchereria bancrofti*) live in the lymphatic system of man, where they obstruct the flow of lymph, causing a severe condition known as elephantiasis (filariasis), in which the limbs grow to enormous size. Intermediate host is *Culex* mosquito. When a carrier *Culex* mosquito bite human being, the microfilaria are transmitted.
- 80.(2) Pasteurization is a method of heat disinfection, commonly applied to milk, wine and cider. The process prolongs the shelf life of such products by decreasing the number of organisms that can cause spoilage. Milk borne diseases such as tuberculosis, brucellosis, certain streptococcal infections, staphylococcal food poisoning, salmonellosis, diphtheria, etc., are prevented by pasteurization. These microorganisms that cause the milk-borne diseases are killed by exposure to 62.9°C for 30 minutes.
- 81.(1) The body symmetry of both frog and locust are bilateral symmetry. And they are triploblastic i.e., with three body layers.
- 82.(2) Biological controls of pest is the use of natural predators, pathogens, or competitors to regulate pest populations.
- 83.(4) Parathyroid hormone (PTH) stimulates the kidneys to reabsorb Ca^{++} from the urine and leads to the activation of vit. D, which is necessary for Ca^{++} absorption by the intestine.
- 84.(3) These plants are aquatic plants, having less xylem.
- 85.(1) Homologous chromosomes form pairs in zygotene stage of prophase-I. The paired chromosomes form a complex known as synaptonemal complex.
- 86.(2) Test cross ratio for monohybrid cross is 1:1 and dihybrid cross is 1:1:1:1. Homozygous recessive parent is crossed with F1 individuals to determine homozygosity or heterozygosity.
- 87.(1) Dumb-bell shaped guard cells (stomatal cell) are found in monocots. e.g., wheat. In dicotyledonous plant, the guard cells are kidney-shaped. Bean, groundnut and sunflower are dicots.
- 88.(1) Adrenal & suprarenal signifies the same. Adrenal gland is also called suprarenal as it is on the top of kidney (renal).
- 89.(1) Monocotyledonous plants show parallel venation with scattered vascular bundles.
- 90.(4) Palisade parenchyma is on the upper half of leaf, just beneath the upper epidermis. Palisade parenchyma contains dense chlorophyll. It is a characteristic of dicot leaf.
- 91.(1) Apple & fig are false fruits as, receptacle forms a major part of fruit.
- 92.(1) Carbon dioxide is reduced to form carbohydrate. Therefore, CO_2 concentration increases to increase the rate of photosynthesis. Light & temperature also contribute in this process.
- 93.(1) Cytokinins help in cell division. Cytokinin conjugates with auxins for proper cell division. More auxin initiates root formation wherever more cytokinins initiates shoot formation.
- 94.(2) Turgor movements, i.e. osmotic concentration change helps in rolling of many grasses in dry weather.
- 95.(1) Vernalisation is flowering at low temperature.

96.(3) Yellow seed colour is dominant and axial flower position is dominant. Green, seed colour and terminal flower position are recessive.

97.(4) *Triticum aestivum* = 42

Triticum durum = 28

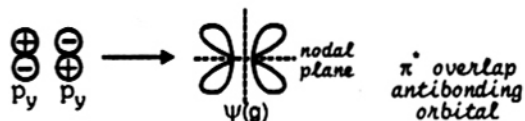
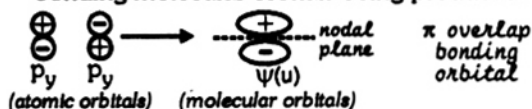
Triticum monococcum = 7

98.(2) June.6

99.(2) Magnesium is located at the centre of the porphyrin ring in chlorophyll.

100.(3) The most abundant chemical element found in the entire living world is carbon.

101.(3) Lateral overlap of $p_y - p_y$ orbitals will occur, resulting in π bonding and π^* antibonding molecular orbitals being produced.



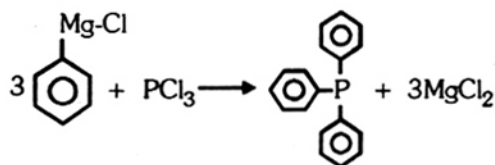
From figure it is very clear that π^* p_y antibonding molecular orbital have two nodal plane perpendicular to each other.

102.(3) According to absolute enthalpies of hydration of dipositive d^n ions the order should be $Cr > V > Mn > Ca$

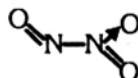
But general trend for the enthalpy of hydration from graphical representation will be $Mn(II) > Cr(II) > V(II) > Ca(II)$

103. (3) Linkage isomerism arises because some ligands like $-NO_2$, SCN^- (Thiocyanate), can co-ordinate to metals in more than one way. These ligands contain more than one atom which could donate an electron pair. In the SCN^- ion either S or N atom could act as the electron pair donor. Thus there is the possibility of isomerism. These two linkage isomers of cobalt complex has $Co-SCN^-$ linkage and $Co-N^+CS$ linkage

104. (1) Triarylphosphines are prepared most conveniently by the action excess of Grignard reagent (i.e, $Ar Mg Cl$) on phosphorus trihalide.



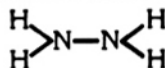
105 (2) The compound N_2O_3 contains N-N bonding as



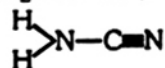
N_2O also contain N-N bonding as



N_2H_4 also contain N-N bonding as

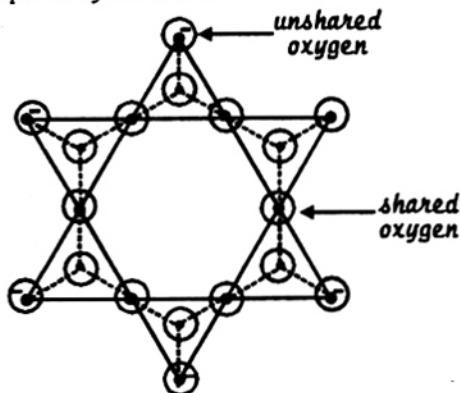


But CN_2^- ion does not contain such type of bonding as in H_2NCN i.e.,



106. (1) The stability of fluoride increases as the size of central atom increases. So, correct of stability will be $PbF_2 > SnF_2 > GeF_2$

107.(4) In the $Si_6O_{18}^{12-}$ ion only six oxygen atoms are shared by other tetrahedron. This is an example of cyclic silicates.

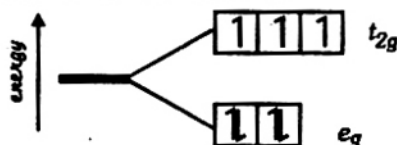


There are 12 oxygen atoms which are not shared by other tetrahedron

108. (4) The 'spin only' magnetic moment can be calculated by the formula

$$\mu_s = \sqrt{n(n+2)} BM$$

For Co^{2+} in a tetrahedral field



There are three unpaired electrons, so, spin only magnetic moment

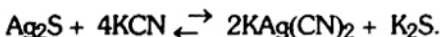
$$\mu_s = \sqrt{3(3+2)} \text{ BM} = 3.87 \text{ BM}$$

This value is less than 4.0 BM

109. (1) BF_3 is electron deficient species and behaves as Lewis acid because it accepts lone pair electron from Et_2O :

110. (1) Iodine oxidises NaHSO_3 to NaHSO_4
 $\text{NaHSO}_3 + \text{I}_2 + \text{H}_2\text{O} \rightarrow \text{NaHSO}_4 + 2\text{HI}$

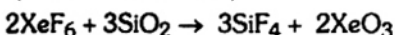
111. (2) Silver, Ag^+ ion when react with KCN , it dissolves slowly and form potassium argentocyanide



In excess it dissolves readily

112. (2) AlCl_3 on reaction with excess of NaOH gives white precipitate of aluminium hydroxide
 $\text{AlCl}_3 + 3\text{NaOH} \rightarrow \text{Al}(\text{OH})_3 + 3\text{NaCl}$
 white ppt.

113. (1) Xenon hexafluoride readily reacts with SiO_2 and gives SiF_4 . This is the basic reason that XeF_6 cannot be stored in glass vessel, that is why XeF_6 is stored in nickel alloy (monel metal vessel)



114. (2) Ligands are lewis base because it donates its lone pair of electrons to the central atom. The order of electron donating tendency will be $\text{NH}_3 > \text{H}_2\text{O} > \text{I}^- > \text{CO}$

115. (1) For the reactions



If reaction is carried out in quite air its variation with temperature can be described as follows

$$\log \frac{K_2}{K_1} = \log K_p = \frac{\Delta H}{2.303 R} \left[\frac{T_2 - T_1}{T_1 T_2} \right]$$

So, it will decompose completely at low temperature, i.e., 1214 K

116. (3) No. of moles of water

$$= \frac{1}{18} = 0.555 \text{ mol}$$

since 1 mol of H_2O has ΔH_{fus}

$$= 1.435 \times 10^3 \text{ cal}$$

\therefore 0.555 mol. of H_2O has ΔH_{fus}

$$= 1.435 \times 10^3 \times 0.555 \text{ cal}$$

$$= 79.7 \text{ cal per gram.}$$

since freezing is an exothermic process that is why its value should be negative i.e.

$$\Delta H_{\text{freezing}} = -79.7 \text{ cal/g.}$$

117. (3) Conversion of atomic chloride to chlorine gas (Cl_2) leads to change in entropy i.e. decrease in entropy $\Delta S < 0$. Bond formation is an exothermic process, it means the value of ΔH will be negative. So, ΔH will be negative and ΔS also be negative

118. (3) Number of moles of Oxygen

$$= \frac{4}{32} = \frac{1}{8} = 0.125 \text{ mol}$$

At same temperature same amount (equal number of moles) of nitrogen can occupy same volume. So, number of gram of Nitrogen

$$= 28 \times 0.125 = 3.4 \text{ g.}$$

119. (1) No. of half life = $\frac{80}{20} = 4 = n$

The activity of $^{90}_{38}\text{Si}$ after 80 years

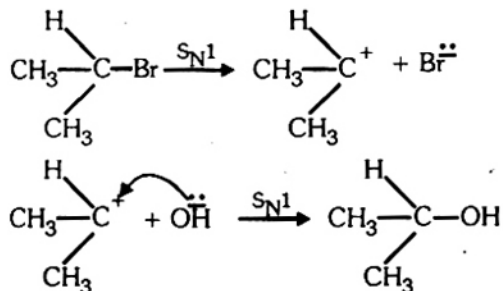
$$= \frac{8000}{2^n} \text{ disintegration/min}$$

$$= \frac{8000}{16} = 500 \text{ disinti/min}$$

- 120 (1) The bond length follow the order as

$$\text{CN}^- > \text{CN} > \text{CN}^+$$

121. (1) Secondary alkyl halide may under go nucleophilic substitution by either $\text{S}_\text{N}1$ or $\text{S}_\text{N}2$ mechanism depending up on the nature of solvent. But primary alkyl halide under go $\text{S}_\text{N}2$ substitution. In the given list only $(\text{CH}_3)_2\text{CHBr}$ is 2° alkyl halide rest are primary alkyl halide.



122. (1) $\text{C}_6\text{H}_5\text{CH}_3$ contains $-\text{CH}_3$ group it is electron pumping in nature. Due to electron pumping ortho and para position becomes electron rich it provides way to electrophilic aromatic substitution.

123. (3) Acetophenone can be prepared by catalytic air oxidation of ethyl benzene. Even $\text{C}_6\text{H}_5\text{CH}=\text{CH}_2$ can reduce, then oxidize to acetophenone. From the reduction of $\text{C}_6\text{H}_5\text{CO}_2\text{CH}_3$ acetophenone can be prepared. It is very difficult to prepare acetophenone from $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_3$.

124. (1) Stronger the acid lower the pK_a value. $\text{CH}_3\text{CH}_2\text{COOH}$ contains ethyl group which is electron pumping group. It increases electron density over oxygen atom of carboxylic acid which finally retards the removal of H^+ ion from $-\text{COOH}$ group. Hence, pK_a value of this group is highest. $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$ is stronger acid because it contains electron withdrawing group, hence, pK_a is lowest.

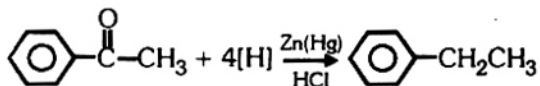
125. (2) The reactivity of carbanion depends upon electron pumping group.

$\begin{array}{c} \text{O} \\ || \\ \text{C}_6\text{H}_5-\text{C}-\text{O}- \end{array}$

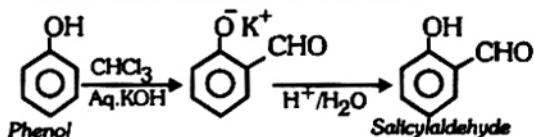
$-\text{NO}_2$ are electron withdrawing group. Electron pumping group increases the reactivity of carbanion where as electron withdrawing group reduces its reactivity. Hence, CH_3CH_2^- is most reactive carbanion.

126. (4) Ketone and aromatic aldehyde do not react with Fehling's solution. Benzoic acid ($\text{pK}_\text{a} = 4.20$) is stronger acid it reduces Fehling's solutions.

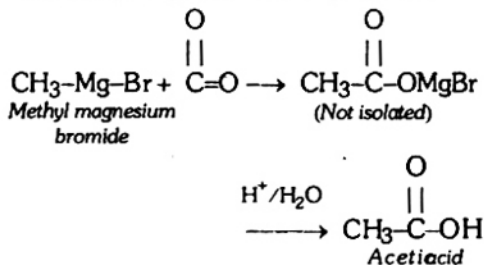
127. (3) Acetophenone undergoes reduction with sodium amalgam in HCl to give ethyl benzene. This is Clemmensen reduction.



128. (1) The treatment of phenol with chloroform in aqueous sodium/potassium hydroxide solution followed by acid hydrolysis. Salicylaldehyde is formed. If CCl_4 is used in CHCl_3 salicylic acid is formed. This reaction is known as Reimer-Tiemann reaction.

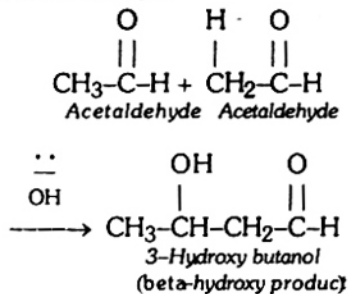


129. (2) Grignard reagent (RMgX) reacts with carbon dioxide to form addition products that can be hydrolysed to carboxylic acids

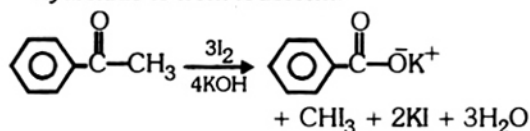


130 (1) α -Keratins are insoluble in water and these are fibrous or structural proteins these are structurally α -Helical in which hydrogen bonds formed between a carbonyl oxygen and the NH of the fourth residue along the same chain

131. (2) Aldehyde containing α -hydrogens undergo self addition in the presence of a base to form aldol product. It gives p -hydroxy products. For example

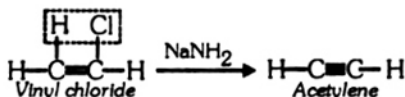


132. (1) Acetophenone is methyl ketone and reacts with iodine in the presence of potassium hydroxide to form iodoform.



- 133(1) Haem, $\text{C}_{34}\text{H}_{32}\text{FeN}_4\text{O}_4$ is the combination of protoporphyrin IX and iron. Structurally it resembles haematin with the iron in Fe(II) state.

- 134(4) The vinyl halides are unreactive and a stronger base (NaNH_2) is used to remove the HCl molecule. Acetylene can be prepared by this method



- 135.(3) Reduction potentials of the two half cells

$$\text{Mg} + 2\text{e}^- \rightleftharpoons \text{Mg(s)}; E^\circ = -2.37\text{V}$$

$$\text{Cu} + 2\text{e}^- \rightleftharpoons \text{Cu(s)}; E^\circ = +0.34\text{V}$$

Reduction takes place at cathode



$$E^\circ_{\text{cell}} = E^\circ_{\text{(R)}} - E^\circ_{\text{(L)}}$$

$$E^\circ_{\text{(R)}} = E^\circ_{\text{Cu}}; E^\circ_{\text{(L)}} = E^\circ_{\text{Mg}}$$

$$E^\circ_{\text{cell}} = 0.34 - (-2.37) = 2.71\text{V}$$

$$136 (3) K_{\text{sp}} = (2s)^2(s) = 4s^3$$

$$137.(4) \text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$$

$$-\frac{\delta[\text{N}]}{\delta t} = -\frac{1}{3} \frac{\delta[\text{H}_2]}{\delta t} = \frac{1}{2} \frac{\delta[\text{NH}_3]}{\delta t}$$

$$\text{if } \frac{\delta[\text{NH}_3]}{\delta t} = 2.0 \times 10^{-4}$$

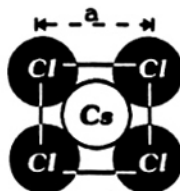
$$\begin{aligned} \text{then, } \frac{\delta[\text{H}_2]}{\delta t} &= \frac{3}{2} \times 2.0 \times 10^{-4} \\ &= 3.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1} \end{aligned}$$

- 138.(3) During the process of electrolysis between two electrodes of same metals like in this case of copper, the amount of cathode by weight will increase and same amount of an-

ode will decrease. But the concentration of solution never changes.

- 139.(1) Since, the alcohol is in large excess, therefore, its change in concentration will be very less. So, the rate of reaction will depend upon only the change in the concentration of acetic anhydride. In any reaction when rate of reaction depends upon the concentration of one of the reactant it is said to be first order reaction.

- 140.(2)



$$\text{Mass of each molecule} = \frac{132.9 + 35.5}{6.023 \times 10^{23}}$$

$$\text{Mass of unit cell} = \text{No. of molecules per unit cell} \times \text{mass of each molecule}$$

$$= \frac{1 \times 168.4}{6.023 \times 10^{23}}$$

Density of unit cell

$$= \frac{\text{Mass}}{\text{Volume}} = \frac{168.4}{6.023 \times 10^{23} \times a^3}$$

$$4 = \frac{168.4}{6.023 \times 10^{23} \times a^3}$$

$$\begin{aligned} a^3 &= \frac{168.4}{24.092 \times 10^{23}} = 6.98 \times 10^{-23} \text{ cm}^3 \\ &\approx 7 \times 10^{-23} \text{ cm}^3 \end{aligned}$$

- 141.(3) Inhaled carbon monoxide does not get absorbed in the body & is known to hamper haemoglobin formation.

142. (3) Dialysis is a method of removing toxic wastes from the blood, effectively substituting a machine for the kidney's homeostatic mechanisms. In hemodialysis, tubes called catheters are surgically inserted into an artery and a vein usually on the lower arm. Inside the dialysis machine, this blood passes through a disposable unit consisting of many hollow fibres surrounded by a thin membrane of cellulose acetate. This membrane allows

waste materials and ions that have accumulated in the plasma to get down their concentration gradients into a dialyzing fluid that has the same composition as normal plasma.

- 143.(3) Hemophilias are recessive disorders, expressed only when an individual does not possess at least one copy of the normal allele and so cannot produce one of the proteins necessary for clotting. Most of the genes that encode the blood-clotting proteins are on autosomes, but two (designated VIII & IX) are on the X-chromosome. So it is a sex-linked inheritance. Any male who inherits a mutant allele of either of those two genes will develop haemophilia because his other sex chromosome is a Y-chromosome, which lacks any alleles of these genes.
- 144.(3) Meristematic cells are highly specialized for cell division. They are undifferentiated cells from which new cells arise. They are not lignified.
- 145.(4) Complete oxidation of one molecule of glucose yields 36 molecules of ATP. Incomplete oxidation of glucose in muscle cells during active exercise yields lactic acid.
- 146.(1) T-cells originate from the bone marrow and its maturation takes place in the thymus. It can identify microorganisms and viruses by the antigens exposed on their surface. Tens of millions of different T cells are made, each specializing in the recognition of one particular foreign antigen. No invader can escape being recognised by at least a few T cells.
- 147.(1) Pace maker is a heart saving device from which electrical impulses pass through the wall of auricle to ventricle & stimulate ventricles to pump blood quickly.
- 148.(3) Copper-T is an intrauterine device (IUD) made of small plastic or metal device placed in the uterus. It produces an irritation in the uterus which prevents the implantation of the embryo within the uterine wall. It has failure rate of 2 to 5%.
- 149.(1) In nitrogen fixing bacteria in the root nodules of leguminous plants (pea family, fabaceae) fixed atmospheric nitrogen and converted to ammonia (NH_3). Nitrite forming bacteria combine the ammonia with oxygen,

forming nitrites (NO_2^-). Nitrites are then converted to nitrates (NO_3^-) by another nitrifying bacteria. Nitrates are absorbed by plants and reduced to ammonium (NH_4^+) which is used to build amino acids for peptides proteins.

- 150.(4) The earliest hominids belonging to the genus *Australopithecus* were the direct ancestors of humans. They exhibited bipedalism (walking upright on two feet) and larger brains (400 to 500 cubic centimeters). The oldest australopithecine fossil is over 4 million years old. The fossil was first discovered in 1924, by R. Dart, in South Africa.
- 151.(1) Continuous use of DDT brings a change in gene frequency in mosquitoes. These change makes them DDT resistant. Further reproduction increases the genotype of resistant variety.
- 152.(2) Niche of every species is different & is constituted by its habitat and function.
- 153.(1) Various animals mark their territory by urination & defaecation. Urine of these animals contains pheromones (a hormone) by which animals recognize their territory.
- 154.(4) Human population is currently undergoing exponential phase.
- 155.(1) Heart wood is the secondary xylem which forms the inner core of stem while sapwood surrounds the heartwood. Heartwood is dead and is more durable than sapwood. Heart wood contains various organic compounds like oil, aromatic substance etc. It is a store house for these organic compounds.
- 156.(3) At each full turn of the calvin cycle, a molecule of carbon dioxide enters and a molecule of RuBP is regenerated. Six revolutions of the cycle with the introduction of six molecules of carbon dioxide, are necessary to produce the equivalent of a six-carbon sugar such as a glucose.
- Six molecules of ribulose 1,5-bisphosphate (RuBP) react with six molecules of carbon dioxide to produce six carbon intermediates.
- 157.(4) Magnesium is an important constituent of the pigment chlorophyll.

158.(1) Gir forests is for lions and they need tall grasses to camouflage themselves behind the long grasses

159.(1) Human insulin gene is transferred to the genome of E.coli by recombinant DNA technique and cultured in the E.coli. When this bacterial divides, insulin gene is also replicated and inherited. Insulin is produced by the bacteria along with its own proteins. Insulin proteins are separated, purified and by further modification, it is used for the treatment of diabetic patients.

160.(3) Phenylketonuria, is a rare human hereditary disease diagnosed by the presence of phenylpyruvic acid in the urine. It is caused by a recessive gene in homogygous condition and is held responsible for a variety of symptoms including early idiocy. The symptoms of the disease seems to arise from an accumulation of the amino acid phenylalanine, which is normally a substrate derived from the breakdown of proteins and used in the synthesis of other products. Phenylalanine accumulates because of the inactivation of a specific liver enzyme phenylalanine hydroxylase, preventing the metabolism of phenylalanine to tyrosine.

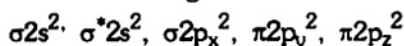
161. (4) Electronic configuration of No molecule is $\sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2, \pi 2p_y^2, \pi 2p_z^2, \pi^* 2p_y^1$.

Bond order

$$= \frac{1}{2} (\text{No. of bonding electron}) - (\text{No. of antibonding electrons})$$

$$= \frac{1}{2} (8-3) = 2.5$$

Electronic configuration of NO^+ molecule is



$$\text{B.O} = \frac{1}{2} (8-2) = 3$$

If B.O is more bond length is small. Hence assertion is wrong and reason is also wrong.

162.(4) Hardness of water is inability of water to form foam with soaps due to the presence of salts of alkaline earth metals. So, assertion is wrong because alkali metals are not responsible for hardness

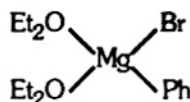
163. (2) It is true that H_2SO_4 (conc.) is an oxidising agent where as H_2S is reducing agent. It is also true about these compound that H_2SO_4 is very good electrolyte as compare to H_2S but this is not the correct explanation of the fact.

164. (3) According to kinetic theory of gases, at any instant, different molecule possess different velocities and hence different energies. However, average K.E of molecules is directly proportional to the absolute temperature. Kinetic energy of a gas is given by

$$E_k = \frac{3}{2} RT$$

165. (4) The X-ray structure of solid $\text{Ph-Mg-Br} \cdot 2\text{Et}_2\text{O}$

shows that the magnesium is tetrahedrally coordinated by Br , Ph , $2\text{Et}_2\text{O}$ (by oxygen atom of ether). But in solution several species may be present.



166. (1) Depression in freezing point

$$\Delta T_f = i K_f m$$

Where K_f molal depression constant

No. of mole of NaCl present in solution

$$= \frac{5.9}{58.5} = 0.10085$$

Now, $\Delta T_f = i \times 1.83 \times 0.10085$

$$\Delta T_f = i \times 0.185$$

$$\Delta T_f = 2 \times 0.185$$

$$\Delta T_f = 0.3691$$

Or depression in freezing point $= (0 - 0.3691)$
 $= - 0.3691^\circ \text{C}$

Here van't Hoff's factor is $i=2$ because it is very good electrolyte, it ionises in water completely.

167. If there is only pressure - volume work the expression for the fact

(Change in internal energy)

$= (\text{Heat absorbed})$

$+ (\text{Work done on the system})$

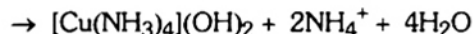
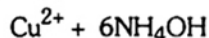
may be written as $\Delta E = q - P\Delta V$

168. (2) It is true that the filaments of bulb is made up of tungsten. It is also true that tungsten has very high electrical resistance. But the correct explanation is that tungsten has very high melting point.

169. (1) It is true that diamond does not conduct electricity due to the presence of only sigma (σ) bond in it and absence of any π bond.

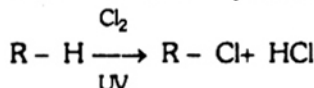
170. (1) It is true that pH of 10^{-9} HCl will not be 9. It is H^+ ion which change the pH which comes from dissociation of water

171. (2)



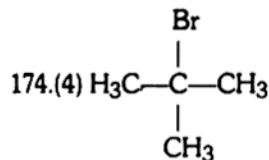
Firstly Cu^{2+} forms $Cu(OH)_2$ then with co-ordination of ammonia it forms deep blue cupra ammonium complex. But this is not the explanation of the assertion.

172. (3) Direct halogenation of alkane is good method of preparation of alkyl halide is true. But it gives mixture of different products.



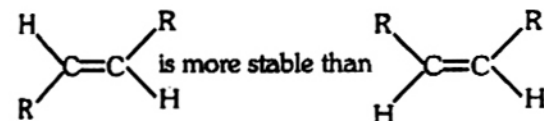
(Mixture of mono, di, tri and tetra halide are also formed)

173. (1) It is true that per oxy benzoic acid polarises the double bond of styrene



2-bromo-2-methylpropane in alcoholic medium, undergo dehydrohalogenation reaction.

175. (2)

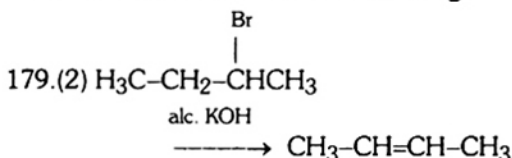


because in trans-dialkyl ethylene repulsion is less or steric effect is less.

176. (1) Aniline reacts with alkyl halides to form 2° amine. $-NH_2$ group reacts with alkyl halide.

177. (2) Fructose reduces Fehlings solution unlike a simple ketone, this is because the alkaline reagents rearrange fructose to give D-glucose and D-mannose which are strong reducing agents.

178. (1) At isoelectric point alanine has zwitter ion structure and it contains no net charge



This is according to Saytzeff's rule, it states that more substituted alkenes are stable.

180. (4) The formation of yellow ppt. of iodoform is used as a test for certain aldehydes and ketone which have methyl group bonded to group CH_3-CO-

181. (1) Both are correct. The electric current having magnitude and direction but it can not be summed as a vector quantity. It can not follow the vector addition law.

182. (1) Both the statement are correct

Due to the total internal reflection the diamond shines brilliantly.

183. (1) Both are correct

Actually the red light has the largest wavelength. So that it can be viewed from a large distance. So we using a red light at the top of building and monuments.

184. (1) Both are correct.

Since this happens only due to the fact that the refractive index of both are the same. The light reflecting from the rod makes internal reflection and gives the same light. So it does not appear.

185. (3) Only A is correct and R is not correct

The situation is that :- due to the large gravitational attraction force between the moon and the earth, the moon is rotating round the sun having only one face towards the earth. We can not view the other side of the moon.

186.(2) Both are correct.

This is the basic principle of the working of SONAR. By this method we can also calculate the distance between the two objects inside the liquid

187.(2) A is correct

B is also correct but it is not the cause of statement A.

Actually the skate blade exerts upward force when we push the skate blade backward. If the skate is tightly pinned into the ice then it exerts more force as forward. So there should be a good forward force having a pointed skate blade.

188.(3). Statement A is correct

Statement B is incorrect

Actually the land cools down fastly and water cools down slowly. So a conventional current of wind is flowing from sea to the land.

189.(1) Both the statements are correct.

The image of a fetus is made with ultrasound and the propagation of this sound waves depend on the nature of the medium.

190. (1) Both are correct.

The change in frequency with the original frequency is related are

$$v = v_0 \left(\frac{1 + v/C}{1 + V/C} \right)$$

Where C = velocity of sound
v = velocity of observer
V = velocity of source

So we see that due to the motion of bats and prey the frequency changes

191.(1) Both these statements are correct

The statement B is the cause of statement A.

192.(1) Both are correct.

Due to the magnification power of the electron microscope we can see the details structure of the tiny particle.

193.(1) The X-ray diffraction is used in the study of the crystal structure the diffraction from a crystal structure is as $2d \sin \theta = n\lambda$

Where, d = interplanar distance

194.(3) A is correct

B is not correct

The sky light is completely unpolarised and only after getting through a polariser, it gets polarised.

195.(3). A is true statement

B is incorrect statement

These bees are able to bite, sting because they are suffocated by not coming of air.

196.(4). Statement A is incorrect

Statement B is not correct

The entropy of the system increases but not always.

197.(3) A is correct statement

B is wrong statement

Since, $P = V \times I$.

So for large V, the power dissipation is large.

198. (3) Assertion is correct statement

Reason is wrong statement

The Basilisk or Jesus Christ Lizard can walk, or rather 'run', on water. It is too heavy to either float or be supported by surface tension. It has powerful legs which give it a terrific running speed, a very long tail for balance and slightly webbed feet to increase the surface area of the foot. It runs on water by moving very fast, slapping its foot down hard on the water such that it creates an upward reaction. The lizard creates an air pocket as it slices down with its foot, and then it pulls its foot out again quickly before the water has time to fill the hole and the lizard starts to sink. In fact if it do slow down, they sink . . . but they're good swimmers.

199.(1) A is incorrect statement

B is correct statement

The rate of flow of the liquid remains the same but the steam changes. The pressure of the liquid will be the same.

200.(1) Both the statements are correct

Some times in the earthquakes the large buildings remain unaffected because the natural frequency of the buildings does not coincide with the frequency of the seismic waves. The seismic waves are the waves formed due to the earthquakes. These waves are always in S.H.M.