

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

Max. Marks : 200

## GENERAL KNOWLEDGE

1. Euthanasia (mercy killing) was first legalized in :

- (1) Switzerland (2) Netherland
- (3) France (4) Italy

2. Positron emission tomography (PET) is one of the best methods for functional imaging because :

- (1) Isotopes of basic body elements are used for imaging
- (2) Isotopes with long half-lives are used
- (3) Isotopes with short half-lives are used
- (4) Positrons are directly involved used in imaging

3. Magnetic Resonance (MR) images are derived from the proton-bearing species present principally from water and :

- (1) Long alkane chain protons of the fatty acid moieties
- (2) Short alkane chain protons of the fatty acid moieties
- (3) Long alkene chain protons of the fatty acid moieties
- (4) Short alkene chain protons of the fatty acid moieties

4. The following separation technique depends on the molecular size of the protein :

- (1) Chromatography on a carboxymethyl (CM) cellulose column
- (2) Iso-electric focusing
- (3) Gel filtration chromatography
- (4) Chromatography on a diethylaminoethyl (DEAE) cellulose column

5. The approximate number of genes contained in the genome of Kalpana Chawla was :

- (1) 40,000 (2) 30,000
- (3) 80,000 (4) 1,00,000

6. In internet what does 'http' mean ?

- (1) High Transfer Text Protocol
- (2) Highest Transfer Text Protocol
- (3) Hyper Text Transfer Protocol
- (4) Hyper Transfer Text Protocol

7. The India-born US physicist who was awarded the Noble prize in Physics for his work on astrophysics is :

- (1) H.G. Khorana
- (2) Subrahmanyam Chandrasekhar
- (3) Sivaramakrishna Chandrasekhar
- (4) C.V. Raman

8. Which German physicist invented the electron microscope which won him the 1986 Noble Prize in Physics ?

- (1) Ernst Ruska (2) Van't Hoff
- (3) J.H.D. Jensen (4) Eugene P Wigner

9. Who was the first Indian to be awarded the World Food Prize in 1987 ?

- (1) M.S. Swaminathan
- (2) Sunderlal Bahuguna
- (3) Anna Hazare
- (4) B.R. Barwale

10. Thanatology is the science that deals with :

- (1) Dealt in all its aspects
- (2) Solving paternity of child
- (3) Identification of living
- (4) Detection of lie

11. What is the disease, Tetanus also known as ?

- (1) Gangrene (2) Shingles
- (3) Lockjaw (4) Whooping Cough

**12. When seen from earth, which of the following planet eclipsed (crossed a cross) of the sun on May 7, 2003 ?**

- (1) Mercury (2) Uranus  
(3) Saturn (4) Jupiter

**13. Israel's Prime Minister Yitzhak Rabin won the Noble Prize for**

- (1) Peace (2) Literature  
(3) Chemistry (4) Economics

**14. Who was the world's first space tourist?**

- (1) Desmond Rickett  
(2) Dennis Tito (3) Igor Kajelnikov  
(4) Li Wang

**15. Which city was gifted to Charles II by the Portuguese when he married the sister of the King of Portugal in 1662 ?**

- (1) Mumbai (2) Paris  
(3) Lisbon (4) Castile

**16. How many "World Cultural Heritage Sites" are there in India ?**

- (1) 10 (2) 17 (3) 14 (4) 15

**17. Who is the mother of Bharat in the epic Ramayana ?**

- (1) Kaushalya (2) Sumitra  
(3) Urmila (4) Kaikayee

**18. Which of the ' Nawab of Bengal ' is supposed to be responsible for 'Black Hole ' of Calcutta (Kolkatta) ?**

- (1) Mir Jafer (2) Sirjuddaula  
(3) Alivardi Khan (4) Sarfaraj Khan

**19. In which country the 'DOGS' were once worshipped as 'GODS' ?**

- (1) Egypt (2) Greece  
(3) Italy (4) Mongolia

**20. From which of the following places the international dateline crosses :**

- (1) Atlantic ocean (2) Pacific ocean  
(3) Greenwich (4) Cape of Good Hope

## BIOLOGY

**21. The crystal of lead zirconate is a key component of :**

- (1) Electroencephalography

- (2) Electrocardiography  
(3) Magnetoencephalography  
(4) Sonography

**22. Which one of the following is a matching pair of a certain body feature and its value count in a normal human adult ?**

- (1) Urea-5-10 mg /100 ml of blood  
(2) Blood sugar (fasting) -70-100-mg/100ml  
(3) Total blood volume -3-4-litres  
(4) ESR in Wintrobe method -9-15 mm in males and 20-34 mm in females

**23. Which one of the following pairs of term/ names mean one and the same thing ?**

- (1) Gene pool -genome  
(2) Codon-gene (3) Cistron-triplet  
(4) DNA fingerprinting -DNA profiling

**24. Which one of the following is a matching pair ?**

- (1) Lubb-Sharp closure of AV valves at the beginning of ventricular systole  
(2) Dup-Sudden opening of semilunar valves at the beginning of ventricular diastole  
(3) Pulsation of the radial artery-Valves in the blood vessels  
(4) Initiation of the heart beat -Purkinje fibres

**25. Mr.X is eating curd/yoghurt .For this food intake in a food chain he should be considered as occupying :**

- (1) First trophic level  
(2) Second trophic level  
(3) Third trophic level  
(4) Fourth trophic level

**26. July 11 is observed as :**

- (1) World Population Day  
(2) No Tobacco Day  
(3) World Environment Day  
(4) World Health Day

**27. Biological Oxygen Demand(BOD) is a measure of :**

- (1) Industrial wastes poured into water bodies  
(2) Extent to which water is polluted with organic compounds

- (3) Amount of carbon monoxide inseparably combined with haemoglobin
- (4) Amount of oxygen needed by green plants during night

**28. Which one of the following is a sesamoid bone ?**

- (1) Pelvis (2) Patella
- (3) Pterygoid (4) Pectoral girdle

**29. Both corpus luteum and macula lutea are :**

- (1) Found in human ovaries
- (2) A source of hormones
- (3) Characterized by a yellow colour
- (4) Contributory in maintaining pregnancy

**30. Photorespiration in  $C_3$  plants starts from :**

- (1) Phosphoglycerate
- (2) Phosphoglycolate
- (3) Glycerate (4) Glycine

**31. Just as *Xenopsylla* is to *Yersenia pestis* so is :**

- (1) Glossian palpalis to *Wuchereria bancrofti*
- (2) *Culex* to *Plasmodium falciparum*
- (3) *Homo sapiens* to *Taenia solium*
- (4) *Phlebotomus* to *Leishmania donovani*

**32. Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to :**

- (1) Vitamin A toxicity
- (2) Kidney stones
- (3) Hypercholesterolemia
- (4) Urine laden with ketone bodies

**33. Drinking of mineral water with very low levels of pesticides (about 0.02 ppm) for long periods may :**

- (1) Produce immunity against mosquito
- (2) Cause leukemia (blood cancer) in most people
- (3) Cause cancer of the intestine
- (4) Lead to accumulation of pesticide residues in body fat

**34. A person passes much urine and drinks much water but blood glucose**

**level is normal . This condition may be the result of :**

- (1) A reduction in insulin secretion from pancreas
- (2) A reduction in vasopressin secretion from posterior pituitary
- (3) A fall in the glucose concentration in urine
- (4) An increase in secretion of glucagon

**35. What is true about tRNA ?**

- (1) It binds with an amino acid at 3' end
- (2) It has five double stranded regions
- (3) It has a codon at one end which recognizes the anticodon on messenger RNA
- (4) It looks like clover leaf in the three dimensional structure

**36. An example of competitive inhibition of an enzyme is the inhibition of :**

- (1) Succinic dehydrogenase by malonic acid
- (2) Cytochrome oxidase by cyanide
- (3) Hexokinase by glucose-6-phosphate
- (4) Carbonic anhydrase by carbon dioxide

**37. Which one of the following is a matching pair of certain organism (s) and the kind of association ?**

- (1) Shark and sucker fish - commensalism
- (2) Algae and fungi in lichens - mutualism
- (3) Orchids growing on trees - parasitism
- (4) *Cuscuta* (dodder) growing on other flowering plants - epiphytism

**38. Photochemical smog formed in congested metropolitan cities mainly consists of**

- (1) Ozone peroxyacetyl nitrate and  $NO_x$
- (2) Smoke, peroxyacetyl nitrate and  $SO_2$
- (3) Hydrocarbons  $SO_2$  and  $CO_2$
- (4) Hydrocarbons ozone and  $SO_x$

**39. In almost all Indian metropolitan cities like Delhi, the major atmospheric pollutant (s) is/are :**

- (1) Suspended particulate matter (SPM)
- (2) Oxides of sulphur
- (3) Carbon dioxide and carbon monoxide
- (4) Oxides of nitrogen

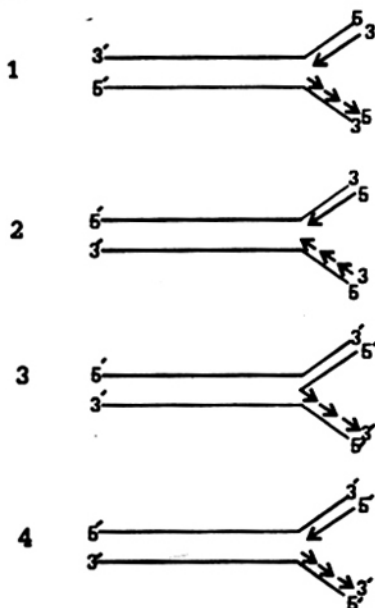
**40. Excessive stimulation of vagus nerve in humans may lead to :**

- (1) Hoarse voice
- (2) Peptic ulcers
- (3) Efficient digestion of proteins
- (4) Irregular contractions of diaphragm

**41 Restriction enzymes:**

- (1) Are endonucleases which cleave DNA at specific sites
- (2) Make DNA complementary to an existing DNA or RNA
- (3) Cut or join DNA fragments
- (4) Are required in vectorless direct gene transfer

**42. Which one of the following correctly represents the manner of replication of DNA ?**

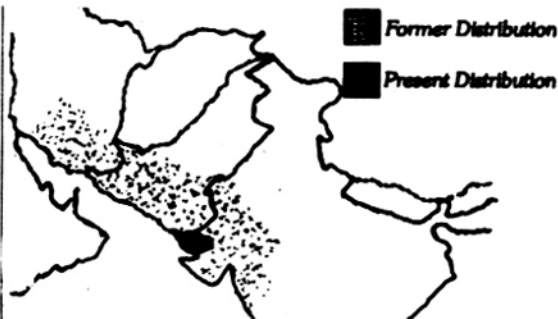


**43. Which one of the following codons codes for the same information as UGC?**

- (1) UGU
- (2) UGA
- (3) UAG
- (4) UGG

**44. The map given below indicates the former and the present distribution of an animal: Which animal could it be ?**

- (1) Wild ass
- (2) Nilgai
- (3) Black buck
- (4) Lion



**45. A person is wearing spectacles with concave lens for correcting vision. While not using the glasses, the image of a distant object in his case will be formed**

- (1) On the blind spot
- (2) Behind the retina
- (3) In front of the retina
- (4) On the yellow spot

**46. The early stage human embryo distinctly possesses :**

- (1) Gills
- (2) gill slits
- (3) External ear (pinna)
- (4) Eye brows

**47. The phase of menstrual cycle in humans that lasts for 7-8 days, is:**

- (1) Follicular phase
- (2) Ovulatory phase
- (3) Luteal phase
- (4) Menstruation

**48. The source of somatostatin is same as that of :**

- (1) Thyroxine and calcitonin
- (2) Insulin and glucagon
- (3) Somatotropin and prolactin
- (4) Vasopresin and oxytocin

**49. People recovering from long illness are often advised to include the alga *Spirulina* in their diet because it .**

- (1) Makes the food easy to digest
- (2) Is rich in proteins
- (3) Has antibiotic properties
- (4) Restores the intestinal microflora

**50. Viroids have :**

- (1) Single stranded RNA not enclosed by protein coat



- (2) Single stranded DNA not enclosed by protein coat
- (3) Double stranded DNA enclosed by protein coat
- (4) Double stranded RNA enclosed by protein coat

**51. In a dicotyledonous stem, the sequence of tissues from the outside to the inside is :**

- (1) Phellem-Pericycle-Endodermis-Phloem
- (2) Phellem-Phloem-Endodermis-Pericycle
- (3) Phellem-Endodermis-Pericycle-Phloem
- (4) Pericycle-Phellem-Endodermis-Phloem

**52. Hill reaction occurs in :**

- (1) High altitude plants
- (2) Total darkness
- (3) Absence of water
- (4) Presence of ferricyanide

**53. Which one of the following pairs is correctly matched**

- 1. *Rhizobium* - Parasite in the roots of leguminous plants.
- 2. Mycorrhizae - Mineral uptake from soil
- 3. Yeast - Production of biogas
- 4. Myxomycetes - The disease ring worm

**54. Pollen grains are able to withstand extremes of temperature and desiccation because their exine is composed of :**

- (1) Cutin
- (2) Suberin
- (3) Sporopollenin
- (4) Callose

**55. One of the genes present exclusively on the X-chromosome in humans is concerned with :**

- (1) Baldness
- (2) Red-green colour blindness
- (3) Facial hair, mustaches in males
- (4) Night blindness

**56. Which one of the following statements with regard to embryonic development in humans is correct ?**

- (1) Cleavage divisions bring about considerable increase in the mass of protoplasm
- (b.) In the second cleavage division, one of the two blastomeres usually divides a little sooner than the second

- (3). With more cleavage divisions, the resultant blastomeres become larger and larger
- (4). Cleavage division results in a hollow ball of cells called morula

**57. Plasmodesmata connections help in :**

- (1) Cytoplasmic streaming
- (2) Synchronous mitotic divisions
- (3) Locomotion of unicellular organisms
- (4) Movement of substances between cells

**58. The quiescent centre in root meristem serves as a**

- (1) Site for storage of food which is utilized during maturation
- (2) Reservoir of growth hormones
- (3) Reserve for replenishment of damaged cells of the meristem
- (4) Region for absorption of water

**59. Azolla is used as a biofertilizer because it**

- (1) Multiplies very fast to produce massive biomass
- (2) Has association of nitrogen-fixing *Rhizobium*
- (3) Has association of nitrogen-fixing Cyanobacteria
- (4) Has association of mycorrhiza

**60. The plant part which consists of two generations one within the other is :**

- (1) Germinated pollen grain
- (2) Embryo
- (3) Unfertilized ovule
- (4) Seed

## CHEMISTRY

**61. The paramagnetic species is :**

- (1)  $\text{KO}_2$
- (2)  $\text{SiO}_2$
- (3)  $\text{TiO}_2$
- (4)  $\text{BaO}_2$

**62. The reagent commonly used to determine hardness of water titrimetrically is:**

- (1) Oxalic acid
- (2) Disodium salt of EDTA
- (3) Sodium citrate
- (4) Sodium thiosulphate

**63. The true statement for the acids of phosphorus.**

**$\text{H}_3\text{PO}_2$ ,  $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$  is :**

- (1) The order of their acidity is  
 $\text{H}_3\text{PO}_4 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_2$   
(2) All of them are reducing in nature  
(3) All of them are tribasic acids  
(4) The geometry of phosphorus is tetrahedral in all the three

**64. The ion which is not tetrahedral in shape is :**

- (1)  $\text{BF}_4^-$  (2)  $\text{NH}_4^+$   
(3)  $\text{Cu}(\text{NH}_3)_4^{2+}$  (4)  $\text{NiCl}_4^{2-}$

**65. The complex used as an anticancer agent is :**

- (1) *mer* -  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$   
(2) *cis*-  $[\text{PtCl}_2(\text{NH}_3)_2]$   
(3) *cis* -  $\text{K}_2[\text{PtCl}_2\text{Br}_2]$   
(4)  $\text{Na}_2\text{CoCl}_4$

**66. The colourless species is :**

- (1)  $\text{VCl}_3$  (2)  $\text{VO}_2\text{SO}_4$   
(3)  $\text{Na}_3\text{VO}_4$   
(4)  $[\text{V}(\text{H}_2\text{O})_6]\text{SO}_4\text{H}_2\text{O}$

**67.  $\text{MnO}_4^{2-}$  (1 mole) in neutral aqueous medium is disproportionate to :**

- (1)  $\frac{2}{3}$  mole of  $\text{MnO}_4^-$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$   
(2)  $\frac{1}{3}$  mole of  $\text{MnO}_4^-$  and  $\frac{2}{3}$  mole of  $\text{MnO}_2$   
(3)  $\frac{1}{3}$  mole of  $\text{Mn}_2\text{O}_7$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$   
(4)  $\frac{2}{3}$  mole of  $\text{Mn}_2\text{O}_7$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$

**68. Lanthanide for which +II and +III oxidation states are common is :**

- (1) La (2) Nd  
(3) Ce (4) Eu

**69. The mixture of concentrated  $\text{HCl}$  and  $\text{HNO}_3$  made in 3: 1 ratio contains :**

- (1)  $\text{ClO}_2$  (2)  $\text{NOCl}$   
(3)  $\text{NCl}_3$  (4)  $\text{N}_2\text{O}_4$

**70. On dissolving moderate amount of sodium metal in liquid  $\text{NH}_3$  at low tem-**

**perature. Which one of the following does not occur ?**

- (1) Blue coloured solution is obtained  
(2)  $\text{Na}^+$  ions are formed in the solution  
(3) Liquid  $\text{NH}_3$  becomes good conductor of electricity  
(4) Liquid ammonia remains diamagnetic

**71. The ligand called  $\pi$  acid is :**

- (1) CO (2)  $\text{NH}_3$   
(3)  $\text{C}_2\text{O}_4^{2-}$  (4) Ethylene diamine

**72. The compound used for gravimetric estimation of copper (II) is :**

- (1)  $\text{Cu}_2(\text{SCN})_2$  (2)  $\text{Cu}_2\text{O}$   
(3)  $\text{Cu}_2\text{I}_2$  (4)  $\text{Cu}_2\text{CO}_3$

**73. In the extraction of the copper from its sulphide ore the metal is formed by reduction of  $\text{Cu}_2\text{O}$  with:**

- (1) FeS (2) CO  
(3)  $\text{Cu}_2\text{S}$  (4)  $\text{SO}_2$

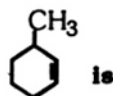
**74. Among the following the strongest acid is :**

- (1)  $\text{CH}_3\text{COOH}$  (2)  $\text{C}_6\text{H}_5\text{COOH}$   
(3) *m* -  $\text{CH}_3\text{OC}_6\text{H}_4\text{COOH}$   
(4) *p* -  $\text{CH}_3\text{OC}_6\text{H}_4\text{COOH}$

**75. Among the following the weakest base is**

- (1)  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$  (2)  $\text{C}_6\text{H}_5\text{CH}_2\text{NHCH}_3$   
(3)  $\text{O}_2\text{NCH}_2\text{NH}_2$  (4)  $\text{CH}_3\text{NHCHO}$

**76. IUPAC name of**



is

- (1) 3-methyl cyclohexene  
(2) 1-methyl cyclohex-2-ene  
(3) 6-methyl cyclohexene  
(4) 1-methyl cyclohex-5-ene

**77. Intermolecular hydrogen bonding is strongest in :**

- (1) Methylamine (2) Phenol

- (3) Formaldehyde (4) Methanol

78. The ortho/para directing group among the following is :

- (1) COOH (2) CN  
(3) COCH<sub>3</sub> (4) NHCOCH<sub>3</sub>

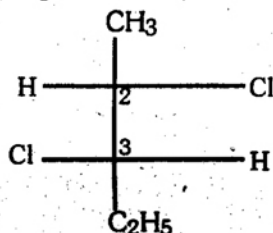
79. The treatment of benzene with isobutene in the presence of sulphuric acid gives :

- (1) Isobutyl benzene (2) *Tert*-butyl benzene  
(3) *n*-Butyl benzene (4) No reaction

80. The most reactive nucleophile among the following is :

- (1) CH<sub>3</sub> O<sup>-</sup> (2) C<sub>6</sub> H<sub>5</sub> O<sup>-</sup>  
(3) (CH<sub>3</sub>)<sub>2</sub> CHO<sup>-</sup> (4) (CH<sub>3</sub>)<sub>3</sub> CO<sup>-</sup>

81. The absolute configuration of the following compound is :



- (1) 2 S, 3 R (2) 2 S, 3 S  
(3) 2 R, 3 S (4) 2 R, 3 R

82. Subunits present in haemoglobin are :

- (1) 2 (2) 3  
(3) 4 (4) 5

83. At higher temperature, iodoform reaction is given by :

- (1) CH<sub>3</sub> CO<sub>2</sub> CH<sub>3</sub> (2) CH<sub>3</sub> CO<sub>2</sub> C<sub>2</sub> H<sub>5</sub>  
(3) C<sub>6</sub> H<sub>5</sub> CO<sub>2</sub> CH<sub>3</sub> (4) CH<sub>3</sub> CO<sub>2</sub> C<sub>6</sub> H<sub>5</sub>

84. Among the following the achiral amino acid is :

- (1) 2-Ethylalanine  
(2) 2-Methylglycine  
(3) 2-Hydroxymethyl serine  
(4) Tryptophan

85. Nitrobenzene gives *N*-phenylhydroxylamine by :

- (1) Sn/HCl (2) H<sub>2</sub>/Pd - C  
(3) Zn/NaOH (4) Zn/NH<sub>4</sub> Cl

86. Propan -1-ol can be prepared from propene by

- (1) H<sub>2</sub> O/H<sub>2</sub> SO<sub>4</sub>  
(2) Hg (OAc)<sub>2</sub>/H<sub>2</sub> O followed by NaBH<sub>4</sub>  
(3) B<sub>2</sub> H<sub>6</sub> followed by H<sub>2</sub> O<sub>2</sub>  
(4) CH<sub>3</sub> CO<sub>2</sub> H/H<sub>2</sub> SO<sub>4</sub>

87. Which of the following are arranged in the decreasing order of dipole moment ?

- (1) CH<sub>3</sub> Cl, CH<sub>3</sub> Br, CH<sub>3</sub> F  
(2) CH<sub>3</sub> Cl, CH<sub>3</sub> F, CH<sub>3</sub> Br  
(3) CH<sub>3</sub> Br, CH<sub>3</sub> Cl, CH<sub>3</sub> F  
(4) CH<sub>3</sub> Br, CH<sub>3</sub> F, CH<sub>3</sub> Cl

88. What is the coordination number of sodium in Na<sub>2</sub> O ?

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

89. Which of the following compounds possesses the C-H bond with the lowest bond dissociation energy ?

- (1) Toluene  
(2) Benzene (3) *n*-Pentane  
(4) 2, 2-Dimethyl propane

90. One gram sample of NH<sub>4</sub> NO<sub>3</sub> is decomposed in a bomb calorimeter. The temperature of the calorimeter increases by 6.12 K. The heat capacity of the system is 1.23 kJ/g/deg. What is the molar heat of decomposition for NH<sub>4</sub> NO<sub>3</sub> ?

- (1) -7.53 kJ/mol (2) -398.1 kJ/mol  
(3) -16.1 kJ/mol (4) -602 kJ/mol

91. Which one of the statements given below concerning properties of solutions describes a colligative effect ?

- (1) Boiling point of pure water decreases by the addition of ethanol  
(2) Vapour pressure of pure water decreases by the addition of nitric acid  
(3) Vapour pressure of pure benzene decreases by the additions of naphthalene  
(4) Boiling point of pure benzene increases by the addition of toluene

92. Which of the following reactions is used to make a fuel cell ?

- (1)  $\text{Cd (s)} + 2 \text{Ni (OH)}_3 \text{ (s)} \longrightarrow \text{CdO (s)} + 2 \text{Ni (OH)}_2 \text{ (s)} + \text{H}_2 \text{O (l)}$   
 (2)  $\text{Pb (s)} + \text{PbO}_2 \text{ (s)} + 2 \text{H}_2 \text{SO}_4 \text{ (aq)} \longrightarrow 2 \text{PbSO}_4 \text{ (s)} + 2 \text{H}_2 \text{O (l)}$   
 (3)  $2 \text{H}_2 \text{ (g)} + \text{O}_2 \text{ (g)} \longrightarrow 2 \text{H}_2 \text{O (l)}$   
 (4)  $2 \text{Fe (s)} + \text{O}_2 \text{ (g)} + 4 \text{H}^+ \text{ (aq)} \longrightarrow 2 \text{Fe}^{2+} \text{ (aq)} + 2 \text{H}_2 \text{O (l)}$

**93. Which one of the following is NOT a buffer solution ?**

- (1)  $0.8 \text{M H}_2 \text{S} + 0.8 \text{M KHS}$   
 (2)  $2 \text{M C}_6 \text{H}_5 \text{NH}_2 + 2 \text{M C}_6 \text{H}_5 \text{NH}_3 \text{Br}$   
 (3)  $3 \text{M H}_2 \text{CO}_3 + 3 \text{M KHCO}_3$   
 (4)  $0.05 \text{M KClO}_4 + 0.05 \text{M HClO}_4$

**94. Which one of the following has  $\Delta S^\circ$  greater than zero ?**

- (1)  $\text{CaO (s)} + \text{CO}_2 \text{ (g)} \rightleftharpoons \text{CaCO}_3 \text{ (s)}$   
 (2)  $\text{NaCl (aq)} \rightleftharpoons \text{NaCl (s)}$   
 (3)  $\text{NaNO}_3 \text{ (s)} \rightleftharpoons \text{Na}^+ \text{ (aq)} + \text{NO}_3^- \text{ (aq)}$   
 (4)  $\text{N}_2 \text{ (g)} + 3 \text{H}_2 \text{ (g)} \rightleftharpoons 2 \text{NH}_3 \text{ (g)}$

**95. The quantum number 'm' of a free gaseous atom is associated with :**

- (1) The effective volume of the orbital  
 (2) the shape of the orbital  
 (3) The spatial orientation of the orbital  
 (4) The energy of the orbital in the absence of a magnetic field

**96. Which one of the following is not a surfactant ?**

- (1)  $\text{CH}_3 - (\text{CH}_2)_{15} - \overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{N}^+}} - \text{CH}_3 \text{Br}^-$   
 (2)  $\text{CH}_3 - (\text{CH}_2)_{14} - \text{CH}_2 - \text{NH}_2$   
 (3)  $\text{CH}_3 - (\text{CH}_2)_{16} - \text{CH}_2 \text{OSO}_3^- \text{Na}^+$   
 (4)  $\text{OHC} - (\text{CH}_2)_{14} - \text{CH}_2 - \text{COO}^- \text{Na}^+$

**97. Time required to deposit one millimole of aluminum metal by the passage of**

**9.65 amperes through aqueous solution of aluminum ion is :**

- (1) 30 s (2) 10 s  
 (3) 30,000 s (4) 10,000 s

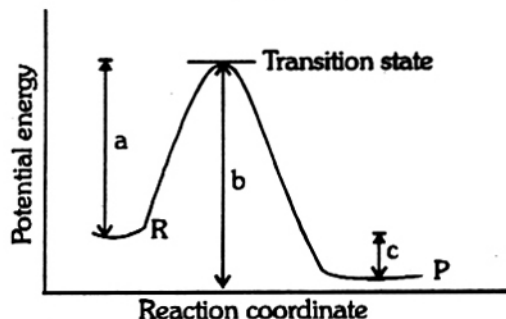
**98. In which of the following acid-base titration, pH is greater than 8 at equivalence point :**

- (1) Acetic acid versus ammonia  
 (2) Acetic acid versus sodium hydroxide  
 (3) Hydrochloric acid versus ammonia  
 (4) Hydrochloric acid versus sodium hydroxide

**99. Which of the following is not a green house gas ?**

- (1) Carbon dioxide (2) Water vapour  
 (3) Methane (4) Oxygen

**100. The potential energy diagram for a reaction  $\text{R} \longrightarrow \text{P}$  is given below**



**$\Delta H^\circ$  of the reaction corresponds to the energy**

- (1) a (2) b  
 (3) c (4) a + b

## PHYSICS

**101. The velocity with which a projectile must be fired so that it escapes earth's gravitation does not depend on :**

- (1) Mass of the earth  
 (2) Mass of the projectile  
 (3) Radius of the projectile's orbit  
 (4) Gravitational constant

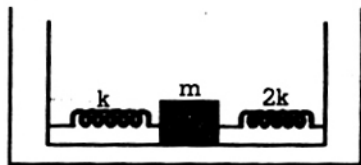
**102. Bernoulli's equation is a consequence of conservation of :**

- (1) Energy (2) Linear momentum

- (3) Angular momentum  
(4) Mass
- 103. A laser beam is used for carrying out surgery because it :**  
 (1) Is highly monochromatic  
 (2) Is highly coherent  
 (3) Is highly directional  
 (4) Can be sharply focused
- 104. A wire of length  $L$  is drawn such that its diameter is reduced to half of its original diameter. If the initial resistance of the wire  $10\Omega$ , its new resistance would be :**  
 (1)  $40\Omega$  (2)  $80\Omega$  (3)  $120\Omega$  (4)  $160\Omega$
- 105. A proton is about 1840 times heavier than an electron. When it is accelerated by potential difference of 1 kV, its kinetic energy will be :**  
 (1) 1840 keV (2)  $1/1840$  keV  
 (3) 1 keV (4) 920 keV
- 106. An electric dipole placed in a non-uniform electric field experiences :**  
 (1) Both a torque and a net force  
 (2) Only a force but no torque  
 (3) Only a torque but no net force  
 (4) No torque and no net force
- 107. In an ideal parallel LC circuit, the capacitor is charged by connecting it to a dc source which is then disconnected. The current in the circuit :**  
 (1) Becomes zero instantaneously  
 (2) Grows monotonically  
 (3) Decays monotonically  
 (4) Oscillates instantaneously
- 108. To a germanium sample, traces of gallium are added as an impurity. The resultant sample would behave like :**  
 (1) A conductor  
 (2) A p-type semiconductor  
 (3) An n-type semiconductor  
 (4) An insulator
- 109. A radioactive substance decays to  $1/16^{\text{th}}$  of its initial activity in 40 days.**

**The half-life of the radioactive substance expressed in days is :**

- (1) 2.5 (2) 5 (3) 10 (4) 20
- 110. A neutron makes a head on elastic collision with a stationary deuteron. The fractional energy loss of the neutron in the collision is**  
 (1)  $16/81$  (2)  $8/9$  (3)  $8/27$  (4)  $2/3$
- 111. The motion of planets in the solar system is an example of the conservation of :**  
 (1) Mass (2) Linear momentum  
 (3) Angular momentum  
 (4) Energy
- 112. Two small drops of mercury each of radius  $R$ , coalesce to form a single large drop. The ratio of the total surface energies before and after the change is :**  
 (1)  $1 : 2^{1/3}$  (2)  $2^{1/3} : 1$   
 (3)  $2 : 1$  (4)  $1 : 2$
- 113. A black body, at a temperature of  $227^\circ\text{C}$ , radiates heat at a rate of  $20 \text{ cal m}^{-2} \text{ s}^{-1}$ . When its temperature is raised to  $727^\circ\text{C}$ , the heat radiated by it in  $\text{cal m}^{-2} \text{ s}^{-1}$  will be closest to :**  
 (1) 40 (2) 160 (3) 320 (4) 640
- 114. Two springs of force constants  $k$  and  $2k$  are connected to a mass as shown below :**



**The frequency of oscillation of the mass is:**

- (1)  $(1/2\pi) \sqrt{(k/m)}$  (2)  $(1/2\pi) \sqrt{(2k/m)}$   
 (3)  $(1/2\pi) \sqrt{(3k/m)}$  (4)  $(1/2\pi) \sqrt{(m/k)}$
- 115. When a beam of light is used to determine the position of an object, the maximum accuracy is achieved if the light is :**

- (1) Polarized
- (2) Of longer wavelength
- (3) Of shorter wavelength
- (4) Of high intensity

**116. 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 downward by 10 fringes

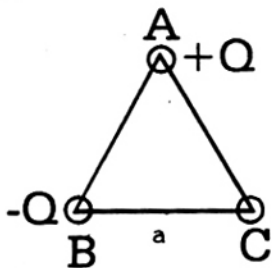
**117. If an electron and a photon propagate in the form of waves having the same wavelength, it implies that they have the same :**

- (1) Energy
- (2) Momentum
- (3) Velocity
- (4) Angular momentum

**118. Characteristic X-rays are produced due to :**

- (1) Transfer of momentum in collision of electrons with target atoms
- (2) Transition of electrons from higher to lower electronic orbits in an atom
- (3) Heating of the target
- (4) Transfer of energy in collision of electrons with atoms in the target

**119. Three charges are placed at the vertices of an equilateral triangle of side 'a' as shown in the following figure. The force experienced by the charge placed at the vertex A in the direction normal to BC is :**



(1)  $Q^2/(4\pi\epsilon_0 a^2)$     (2)  $-Q^2/(4\pi\epsilon_0 a^2)$

(3) Zero    (4)  $Q^2/(2\pi\epsilon_0 a^2)$

**120. A capacitor of capacitance  $2 \mu\text{F}$  is connected in the tank circuit of an oscillator oscillating with a frequency of 1 kHz. If the current flowing in the circuit is 2 mA, the voltage across the capacitor will be :**

- (1) 0.16V
- (2) 0.32V
- (3) 79.5V
- (4) 159V

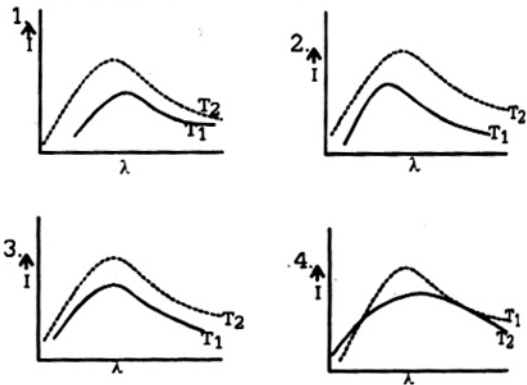
**121. The earth's magnetic field at a given point is  $0.5 \times 10^{-5} \text{ Wb m}^{-2}$ . This field is to be annulled by magnetic induction at the centre of a circular conducting loop of radius 5.0 cm. The current required to be flown in the loop is nearly :**

- (1) 0.2 A
- (2) 0.4 A
- (3) 4 A
- (4) 40 A

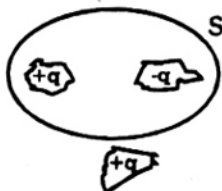
**122. A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible because the body of the frog behaves as :**

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

**123. Shown below are the black body radiation curves at temperatures  $T_1$  and  $T_2$  ( $T_2 > T_1$ ). Which of the following plots is correct ?**

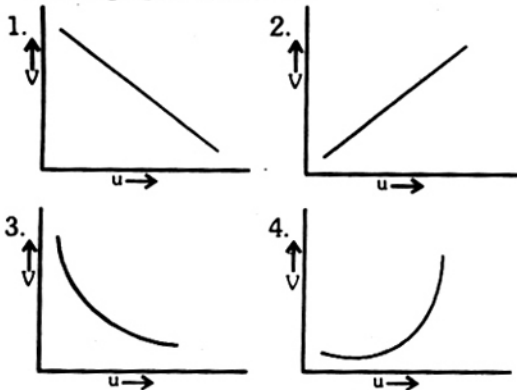


124. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface  $S$  is :



- (1)  $3q/\epsilon_0$       (2)  $2q/\epsilon_0$   
(3)  $q/\epsilon_0$       (4) zero

125. In an experiment to find the focal length of a concave mirror a graph is drawn between the magnitudes of  $u$  and  $v$ . The graph looks like :



126. Nuclear fusion is possible :

- (1) Only between light nuclei  
(2) Only between heavy nuclei  
(3) Between both light and heavy nuclei  
(4) Only between nuclei which are stable against  $\beta$ -decay

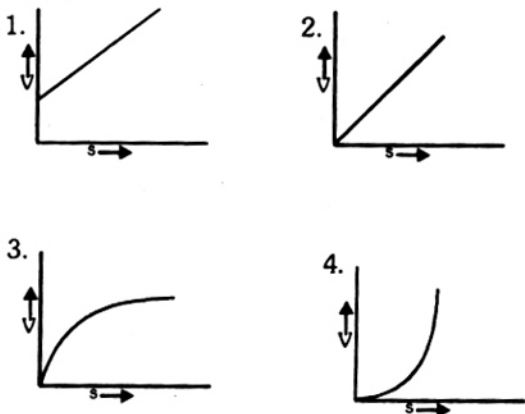
127. An electron is travelling along the  $x$ -direction. It encounters a magnetic field in the  $y$ -direction. Its subsequent motion will be:

- (1) Straight line along the  $x$ -direction  
(2) A circle in the  $xz$ -plane  
(3) A circle in the  $yz$ -plane  
(4) A circle in the  $xy$ -plane

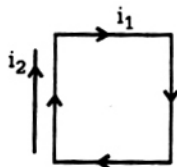
128. The difference in the lengths of a mean solar day and a sidereal day is about :

- (1) 1min      (2) 4min  
(3) 15min      (4) 56 min

129. A body starting from rest moves along a straight line with a constant acceleration. The variation of speed ( $v$ ) with distance ( $s$ ) represented by the graph :



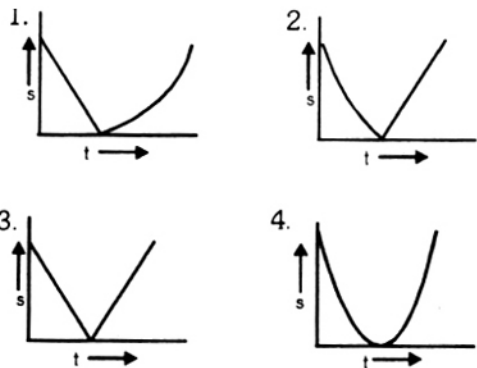
130. A rectangular loop carrying a current  $i_1$  is situated near a long straight wire carrying a steady current  $i_2$ . The wire is parallel one of the sides of the loop and is in the plane of the loop as shown in the figure. Then the current loop will:



- (1) Move away from the wire  
(2) Move towards the wire  
(3) Remain stationary  
(4) Rotate about an axis parallel to the wire

131. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its flight if the air resistance is not ignored?





**132. Radioactive nuclei that are injected into a patient collect at certain sites within its body, undergoing radioactive decay and emitting electromagnetic radiation. These radiations can then be recorded by detector. This procedure provides an important diagnostic tool called:**

- (1) Gamma camera
- (2) CAT scan
- (3) Radiotracer technique
- (4) Gamma ray spectroscopy

**133. In a material medium, when a positron meets an electron both the particles annihilate leading to the emission of two gamma ray photons. This process forms the basis of an important diagnostic procedure called :**

- (1) MRI
- (2) PET
- (3) CAT
- (4) SPECT

**134. An astronaut is looking down on earth's surface from a space shuttle at an altitude of 400 km. Assuming that the astronaut's pupil diameter is 5 mm and the wavelength of visible light is 500 nm, the astronaut will be able to resolve linear objects of the size of about :**

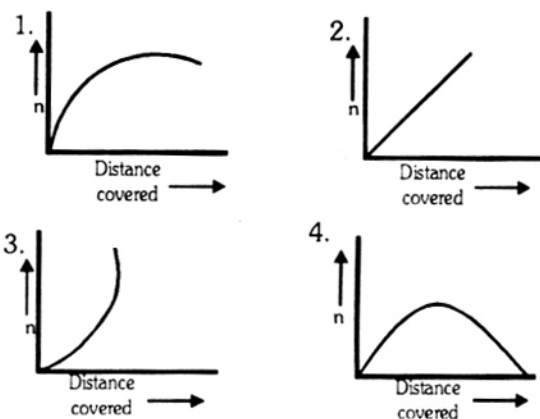
- (1) 0.5 m
- (2) 5 m
- (3) 50 m
- (4) 500 m

**135. An earthquake generates both transverse (S) and longitudinal (P) sound waves in the earth. The speed of S waves is about 4.5 km/s and that of P waves is about 8.0 km/s.**

**A seismograph records P and S waves from an earthquake. The first P wave arrives 4.0 min before the first S wave. The epicenter of the earthquake is located at a distance of about**

- (1) 25 km
- (2) 250 km
- (3) 2500 km
- (4) 500 km

**136. A lead shot of 1 mm diameter falls through a long column of glycerine. The variation of its velocity  $v$  with distance covered is represented**



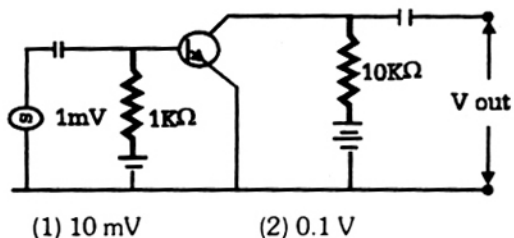
**137. The maximum distance upto which TV transmission from a TV tower of height  $h$  can be received is proportional to :**

- (1)  $h^{1/2}$
- (2)  $h$
- (3)  $h^{3/2}$
- (4)  $h^2$

**138. In short wave communication waves of which of the following frequencies will be reflected back by the ionospheric layer having electron density  $10^{11}$  per  $m^{-3}$  ?**

- (1) 2 MHz
- (2) 10 MHz
- (3) 12 MHz
- (4) 18 MHz

**139. In the following common emitter configuration an npn transistor with current gain  $\beta = 100$  is used. The output voltage of the amplifier will be :**



- (3) 1.0 V                      (4) 10 V
- 140. Using mass (M) length (K) , time (T) and current (I) as fundamental quantities. the dimension of permeability is :**
- (1)  $M^{-1} LT^{-2} A$                       (2)  $ML^2 T^{-2} A^{-1}$   
 (3)  $MLT^{-2} A^{-2}$                       (4)  $MLT^{-1} A^{-1}$

## ASSERTION AND REASONING

§ In 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

### Assertion

### Reason

- |  |   |
|--|---|
| 141. Mast cells in the human body release excessive amounts of inflammatory chemicals which cause allergic reactions .                 | Allergens in the environment on reaching human body stimulate mast cells in certain individuals |
| 142. Use of fertilizers greatly enhances crop productivity   | Irrigation is very important in increasing crop productivity                                    |
| 143. Smaller the organism higher is the rate of metabolism per gram weight   | The heart rate of a six month old baby is much higher than that of an old person                |
| 144. Bats and whales are classified as mammals   | Bats and whales have four-chambered heart   |
| 145. Severe Acute Respiratory Syndrome (SARS) originated in China  | China is the most populated country of the world  |
| 146. Organochlorine pesticides are organic compounds that have been chlorinated  | Fenitrothion is one of the organochlorine pesticides  |
| 147. Holoblastic cleavage with almost equalized blastomers is characteristic of placental animals                                      | Eggs of most mammals, including humans , are of centrolecithal type                             |
| 148. Inhabitants close to very busy airports are likely to experience health hazards .   | Sound level of jet aeroplanes usually exceeds 160 dB  |
| 149. All birds, except the ones like koel (cuckoo) build nests for retiring and taking rest during night time (day time for nocturnal) | Koel lays eggs in the nests of tailor bird  |
| 150. Old age is not an illness . It is a continuation of life with decreasing capacity for adaptation                                  | Cessation of mitosis is a normal genetically programmed event                                   |

151. A cell membrane shows fluid behaviour
152. In plant tissue culture, somatic embryos can be induced from any plant cell
153. *Rhoeo* leaves contains anthocyanin pigments in epidermal cells
154. Water and mineral uptake by root hairs from the soil occurs through apoplast until it reaches endodermis
155. Long distance flow of photo assimilates in plants occurs through sieve tubes
156. Many visitors to the hills suffer from skin and respiratory allergy problems
157. Yeasts such as *Saccharomyces cerevisiae* are used in baking industry.
158. In a food chain members of successive higher levels are fewer in number
159. Tropical rain forests are disappearing fast from developing countries such as India
160. Leaf butterfly and stick insect show mimicry to dodge their enemies
161. Solution of  $\text{Na}_2\text{CrO}_4$  in water is intensely coloured
162.  $\text{NF}_3$  is a weaker ligand than  $\text{N}(\text{CH}_3)_3$
163.  $\text{PbI}_4$  is a stable compound .
164.  $\frac{22}{11}\text{Na}$  emits a positron giving  $\frac{22}{12}\text{Mg}$
165. Barium is not required for normal biological function in human
166. Haemoglobin is an oxygen carrier
167. Glycosides are hydrolyzed in acidic conditions
168. Benzyl bromide when kept in acetone water it produces benzyl alcohol
169. Activity of an enzyme is pH -dependent

- A membrane is a mosaic or composite of diverse lipids and proteins
- Any viable plant cell can differentiate into somatic embryos
- Anthocyanins are accessory photosynthetic pigments
- Casparian strips in endodermis are suberized
- Mature sieve tubes have parietal cytoplasm and perforated sieve plates
- Conifer trees produce a large quantity of wind-borne pollen grains
- Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion
- Number of organisms at any trophic level depends upon the availability of organism which serve as food at the lower level
- No value is attached to these forests because these are poor in biodiversity
- Mimicry is a method to acquire body colour blending with the surroundings
- Oxidation state of Cr in  $\text{Na}_2\text{CrO}_4$  is +VI
- $\text{NF}_3$  ionizes to give  $\text{F}^-$  ions in aqueous solution
- Iodide stabilizes higher oxidation state .
- In  $\beta^+$  emission neutron is transformed into proton
- Barium does not show variable oxidation state
- Oxygen binds as  $\text{O}^{2-}$  to Fe of hemoglobin
- Glycosides are acetals
- The reaction follows  $\text{S}_\text{N}2$  mechanism
- Change in pH affects the solubility of the enzyme in water

170. Alkyl benzene is not prepared by Friedel - Crafts alkylation of benzene
171. Hydroxyketones are not directly used in Grignard reaction
172. Trans-2-butene on reaction with  $\text{Br}_2$  gives meso-2, 3-dibromobutane
173. Cis-1, 3-dihydroxy cyclohexane exists in boat conformation .
174. The increase in internal energy ( $\Delta E$ ) for the vapourization of one mole of water at 1 atm and 373 K is zero
175.  $\text{BaCO}_3$  is more soluble in  $\text{HNO}_3$  than in plain water
176.  $\Delta H$  and  $\Delta E$  are almost the same for the reaction ,  $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \longleftrightarrow 2 \text{NO} (\text{g})$
177. Photo chemical smog is produced by nitrogen oxides
178. Increasing pressure on pure water decrease its freezing point .
179. The micelle formed by sodium stearate in water has  $-\text{COO}^-$  groups at the surface
180. The O -O bond length in  $\text{H}_2 \text{O}_2$  is shorter than that of  $\text{O}_2 \text{F}_2$  .
181. Temperatures near the sea coast are moderate
182. The earth is slowing down and as a result the moon is coming nearer to it .
183. A tube light emits white light
184. Radioactive nuclei emit  $\beta^-$  particles
185. The resistivity of a semiconductor increase with temperature
186. The Coulomb force is the dominating force in the universe
187. The length of the day is slowly increasing

Alkyl halides are less reactive than acyl halides

Grignard reagents react with hydroxyl group

The reaction involves syn -addition of bromine

In the chair form, there will not be hydrogen bonding between the two hydroxyl groups

For all isothermal processes  $\Delta E = 0$ .

Carbonate is a weak base and reacts with the  $\text{H}^+$  from the strong acid, causing the barium salt to dissociate

All reactants and products are gases

Vehicular pollution is a major source of nitrogen oxides

Density of water is maximum at 273 K

Surface tension of water is reduced by the addition of stearate

$\text{H}_2 \text{O}_2$  is an ionic compound

Water has a high thermal conductivity .

The angular momentum of the earth moon system is not conserved

Emission of light in a tube takes place at a very high temperature .

Electrons exist inside the nucleus

The atoms of a semiconductor vibrate with larger amplitude at higher temperatures thereby increasing its resistivity .

The Coulomb force is weaker than the gravitational force

The dominant effect causing a slowdown in the rotation of the earth is the gravitational pull of other planets in the solar system

188. Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate
  189. The possibility of an electric bulb fusing is higher at the time of switching ON and OFF
  190. The stars twinkle while the planets do not.
  191. A beam of charged particles is employed in the treatment of cancer
  192. When a beetle moves along the sand within a few tens of centimeters of a sand scorpion, the scorpion immediately turns towards the beetle and dashed towards it.
  193. When a bottle of cold carbonated drink is opened, a slight fog forms around the opening
  194. The size of a hydrogen balloon increases as it rises in air
  195. Owls can move freely during night
  196. It is hotter over the top of a fire than at the same distance on the sides
  197. The amplitude of an oscillating pendulum decreases gradually with time
  198. Microwave communication is preferred over optical communication
  199. Neutrons penetrate matter more readily as compared to protons
  200. In high latitudes one sees colourful curtains of light hanging down from high altitudes
- According to classical physics all moving electrons radiate.
- Inductive effects produce a surge at the time of switch-off and switch-on
- The stars are much bigger in size than the planets
- Charged particles on passing through a material medium lose their energy by causing ionization of the atoms along their path
- When a beetle disturbs the sand, it sends pulses along the sand's surface. One set of pulses is longitudinal while the other set is transverse
- Adiabatic expansion of the gas causes lowering of temperature and condensation of water vapours
- The material of the balloon can be easily stretched
- They have large number of rods on their retina
- Air surrounding the fire conducts more heat upwards
- The frequency of the pendulum decreases with time
- Microwaves provide large number of channels and band width compared to optical signals
- Neutrons are slightly more massive than protons
- The high energy charged particles from the sun are deflected to polar regions by the magnetic field of the earth.

## ANSWERS

1.(2) 2.(3) 3.(1) 4.(3) 5.(2) 6.(3) 7.(2) 8.(1) 9.(1) 10.(1) 11.(3) 12.(2)  
13.(1) 14.(2) 15.(1) 16.(2) 17.(4) 18.(2) 19.(1) 20.(2) 21.(2) 22.(2)  
23.(4) 24.(4) 25.(2) 26.(1) 27.(2) 28.(2) 29.(3) 30.(2) 31.(4) 32.(3)  
34.(2) 35.(1) 36.(1) 37.(1, 2) 38.(1) 39.(1) 40.(2) 41.(1) 42.(1) 43.(4)  
44.(1) 45.(3) 46.(2) 47.(2) 48.(4) 49.(2) 50.(1) 51.(3) 52.(4) 53.(2)  
54.(3) 55.(2) 56.(4) 57.(4) 58.(3) 59.(3) 60.(4) 61.(1) 62.(2) 63.(4)  
64.(3) 65.(2) 66.(3) 67.(1) 68.(4) 69.(2) 70.(4) 71.(1) 72.(1) 73.(1)  
74.(2) 75.(3) 76.(1) 77.(2) 78.(4) 79.(2) 80.(4) 81.(2) 82.(3) 83.(4)  
84.(3) 85.(4) 86.(3) 87.(2) 88.(2) 89.(1) 90.(4) 91.(3) 92.(3) 93.(4)  
94.(3) 95.(3) 96.(2) 97.(2) 98.(2) 99.(4) 100.(3)  
101.(2) 102.(1) 103.(4) 104.(4) 105.(3) 106.(1) 107.(1) 108.(2) 109.(3)  
110.(4) 111.(3) 112.(1) 113.(3) 114.(3) 115.(2) 116.(3) 117.(2) 118.(2)  
119.(1) 120.(1) 121.(2) 122.(3) 123.(3) 124.(4) 125.(4) 126.(1) 127.(2)  
128.(2) 129.(3) 130.(2) 131.(4) 132.(3) 133.(2) 134.(3) 135.(3) 136.(1)  
137.(1) 138.(1) 139.(3) 140.(3) 141.(1) 142.(2) 143.(3) 144.(2) 145.(2)  
146.(3) 147.(3) 148.(2) 149.(3) 150.(3) 151.(1) 152.(1) 153.(3) 154.(2)  
155.(1) 156.(2) 157.(1) 158.(4) 159.(3) 160.(1) 161.(1) 162.(1) 163.(?)  
164.(?) 165.(2) 166.(3) 167.(4) 168.(1) 169.(2) 170.(2) 171.(1) 172.(3)  
173.(4) 174.(1) 175.(1) 176.(2) 177.(2) 178.(3) 179.(2) 180.(4) 181.(1)  
182.(4) 183.(1) 184.(3) 185.(2) 186.(3) 187.(?) 188.(1) 189.(1) 190.(2)  
191.(1) 192.(1) 193.(2) 194.(3) 195.(1) 196.(1) 197.(4) 198.(4) 199.(2)  
200.(2)

## EXPLANATIONS

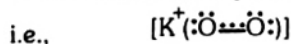
21. The crystal of lead zirconate is a key component of electrocardiography. It is a piezoelectric material (the material which has a net dipole moment and which can produce electricity when subjected to pressure or stress), ceramic or crystal in nature. Thickness of this material is the critical factor which allow proper vibrational frequency.
22. During fasting the sugar is digested from the reserve of thus sugar level goes down.
23. DNA fingerprinting is technically called DNA profiling or DNA typing or genetic finger printing. A technique invented by Sir Alec Jeffery of U.K. (1985) is used to identify a person on the basis of DNA specificity.
24. Increased contraction of ventricular muscles during systole first causes the closure of atrioventricular, bicuspid and tricuspid valve producing low pitch 'LUBB' sound. At the end of ventricular systole, semilunar valves shut producing second short and sharp sound, the 'DUPP'.
25. Plants are first trophic level, herbivores (or dairy breeds) are second and Mr X is in third trophic level.
26. World health day - April 7  
No tobacco day - May 31  
World environment day - June 5
27. By measuring the level of oxygen pollution in water is measured. When larger amount of sewage is dumped into water, the BOD will increase.
28. Sesamoid bones are formed by ossification of tendon at joints
29. The empty follicle during oogenesis develops into corpus luteum. The cytoplasm of the corpus luteum is rich in a yellow pigment called lutein and hence known as yellow spot. Macula lutea is the yellowish spot present at the posterior pole of eye. Lutein, zeaxanthin,  $\alpha$ -carotene and  $\beta$ -cryptoxanthin are responsible of its yellow colouration.
30. During photorespiration  $O_2$  is taken by RuBP carboxylase and thus inhibits  $CO_2$  fixation during  $C_3$  pathway. The phosphoglycolate is converted into glycolate
31. One is a vector and other is pathogen.  
*Leishmania donovani* is pathogen causing kala-azar and sand fly is a vector of this pathogen.  
Similarly Rat flea or *Xenopsylla* is a vector whereas *Yersinia pestis* is a pathogen causing plague.
32. Because these are saturated fat rich substance which accumulate in the arteries and cause hyper cholestolemia
33. Highest amount of DDT can be detected in Indians due to its prolonged use.
34. Vasopressin regulates the amount of urine and thus its low secretion will lead to passage of much urine. Vasopressin has not effect on glucose metabolism.
35. tRNA has four recognition sites among these one is the amino acid attachment site with 3' terminal-CCA sequence.
36. Competitive inhibition is the process by which 2 substrates compete the active site on enzyme and the alternate substrate inhibits the reaction.
37. Mutualism - Both organism benefit - commensalism - one organism gains other is unharmed
38. Photo chemical smog was reported in Los Angeles. These oxidizing type of pollution is characterised by the presence of large concentration of ozone, oxides of nitrogen and various hydrocarbons.  
Nitric oxide (NO) is formed by reaction between oxygen and nitrogen.  
NO reacts with air forming  $NO_2$ .  
 $NO_2$  absorbs light and nitric oxide and nascent oxygen [O] are formed.  
Nascent oxygen combines with molecular oxygen to form ozone  
Ozone reacts with unburnt hydrocarbons to give aldehydes and ketone  
Nitrogen oxides, oxygen and ketone gives rise to PAN
39. Major pollutants like  $SO_2$ ,  $NO_2$  and particular matter in which the SPM (suspended par-



ticulate matter) in Delhi's air exceed the permitted levels.

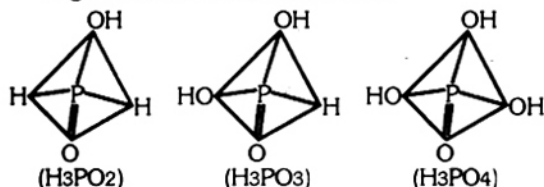
40. Increased stimulation of vagus leads to increase peristalsis resulting in excess secretion of HCl and pepsin in stomach. This leads to erosion of mucus and muscularis mucosa into the submucosa which leads to peptic ulcer.
41. Restriction enzymes or restriction endonucleases cleave DNA to specific sites when nucleotides of the two strands form inverted base sequence and are symmetrical around a given point. They are originally extracted from bacterium *E. coli*.
42. Wild ass is confined to Runn of Kutch (Gujarat). It is an endangered species.
43. Proposed by Watson and Crick. Also known as semi-conservative replication because each new double helix retains one strand of original DNA. Both new strands are synthesized in 5'-3' direction. Thus one strand is synthesized forward and other backward.
44. UGA and UAG are non-sense codons and UGG codes for tryptophan.
45. Concave lens is used for correcting myopia or shortsightedness. In myopia the eye ball is elongated and image is formed in front of retina.
46. Early embryos of different vertebrates resemble in possessing similar structures like notochord, tail, gill slits etc.
47. During ovulatory phase production of FSH decreases, while that of LH increases which leads to ovulation of about 14<sup>th</sup> day. Luteal phase lasts from 15- 28 days Menstrual phase lasts for 3 - 5 days
48. Somatostatin is secreted by delta cells of islets of Langerhans, hypothalamus and some cells of digestive tract. They are stored and released from posterior pituitary gland.
49. *Spirulina platensis* contain 40 to 50% crude protein and its protein has balanced composition containing all essential amino acids. During illness the proteins serve as nutrition and are thus disintegrated therefore protein rich diet is recommended
50. Viroids are discovered by T.O Diener (1971). They consist of a single stranded linear or circular DNA molecule and are not enclosed by protein coat. Its replication requires host's encoded RNA polymerase.
52. Ferricyanide acts as electron receptor which is required for Hill reaction. Other requirement is illumination
53. Mycorrhiza is an example of mutualism. The higher plants provide the fungi with carbohydrates and in return the fungi help the plant in absorption of water, dissolution and absorption of inorganic nutrients locked in organic matter (especially nitrogen and phosphorus) which plant cannot absorb from soil.
54. Exine the outer layer of pollen grain is an acetolysis resistant layer. It is made up of highly resistant fatty substance called sporopollenin. Sporopollenin is a protein which is impervious and this maintains the water in the body
55. Red-green colour blindness is a recessive sex linked trait. The normal gene and its recessive allele are carried by X-chromosome. In male a single recessive gene ( $X^oY$ ) will cause the disease whereas in female both the sex chromosomes carrying recessive gene ( $X^oX^o$ ) will be affected.
56. Morula is a solid mass of 32 cells formed from zygote after successive mitotic division (after third division of cleavage)
57. Plasmodesmata are found in between the cells and act as channels by which the substance passes.
58. Quiescent centre is zone of no activity and this region has low concentration of DNA, RNA and protein
59. Leaves of *Azolla* (a pteridophyte) are associated with blue green algae (*Anabaena azollae*) having capacity to fix atmospheric nitrogen and make it available to *Azolla*.
60. Seed is diploid ( $2n$ ) generation, is capable to produce new plant and also contains diploid ( $2n$ ) embryo. The seed is attached with ( $2n$ ) mother plant, hence attached with parent generation to itself and capable to produce  $F_2$  generation for future.
61. (1) When a substance is placed in a magnetic field it causes greater concentration of the

lines of magnetic force within it self than in the surrounding magnetic field, it is said to exhibit paramagnetism. It is associated with the presence of unpaired electrons in an ion or molecule.  $KO_2$  is paramagnetic molecule because it contains unpaired electron



62. (2) The multidentate ligand, EDTA forms complexes of high stability with various metal ions. This is used in the estimation of hardness of water by a simple titration method. We know that hardness of water is caused by the presence of  $Ca^{2+}$  and  $Mg^{2+}$  ions. The difference in stability constant values, for example, the  $K$  value for  $Ca^{2+}$  and  $Mg^{2+}$  in EDTA complexes are  $10^{10.7}$  and  $10^{8.70}$  respectively which permits the selective estimation of different ions

63. (4) In the case of oxyacids of phosphorus like  $H_3PO_2$ ,  $H_3PO_3$  and  $H_3PO_4$  the central atom has  $sp^3$  hybridisation and therefore, surrounded by neighbouring atom tetrahedrally. Phosphorus occupy the central position and oxygen or  $-OH$  group occupies edges of tetrahedron in all cases



64. (3). Copper in  $Cu(NH_3)_4^{2+}$  is  $dsp^2$  hybridized and due to this reason it has square planar structure

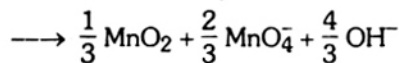
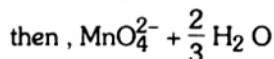
65. (2). An anticancer agent destroys the cancer cells. There are so many anti cancer agent are present but most common is cisplatin. Its chemical formula is  $Cis - [PtCl_2(NH_3)_2]$ . It is a complex compound of Pt.

66. (3). Among  $[V(H_2O)_6]SO_4 \cdot H_2O$ ,  $Na_3VO_4$ ,  $VOSO_4$  and  $VCl_3$  only  $Na_3VO_4$  is colourless species rest are coloured

67. (1). In aqueous medium  $MnO_4^{2-}$  reacts as

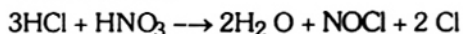


If we take only one molecule of  $MnO_4^{2-}$



68. (4). The oxidation state + (III) is most common in lanthanides, but some lanthanides contains two or three oxidation states. For example, Eu have + (II) and + (III) oxidation state which is very common.

69. (2). The mixture of conc. HCl and  $HNO_3$  in 3 : 1 ratio is commonly known as aqua regia. It is so called because it can dissolve all the noble metals. In this mixture of aqua regia it contains NOCl



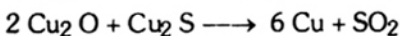
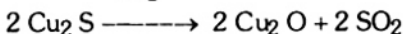
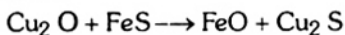
70. (4) Sodium metal dissolves in liquid  $NH_3$  which gives blue solution. Which contain  $Na^+$  ion in solution as solvated state and solvated electrons. It can conduct electricity

71. (1). Ligands such as CO,  $CN^-$  and  $NO^+$

have empty  $\pi$  - orbitals with the correct symmetry to overlap with metal  $t_{2g}$  orbitals, forming  $\pi$  orbitals. This is often described as back bonding. These ligands are known as  $\pi$  - acceptors or  $\pi$  - acids

72. (1) For the gravimetric estimation of copper (II), the compound thiocyanide is used and that compounds  $Cu_2(SCN)_2$

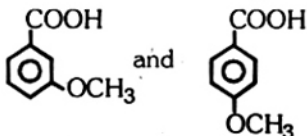
73. (1) The ore of copper is copper pyrite ( $CuFeS_2$ ) from which copper metal is mainly extracted. The reaction involves oxidation of  $Cu_2S$  and then reduction of  $Cu_2O$  to copper metal



- 74.(2) The strongest acid among all given acid is benzoic acid,  $C_6H_5COOH$ . It is due to the fact that

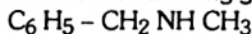


is resonance stabilised, or in other words,  $C_6H_5$  - group is electron withdrawing in nature which withdraw the electron from -COOH group. H atom moves from this as  $H^+$  ion and gives its electron to ring system along with carboxylate ion. In the case of  $CH_3COOH$ ,  $CH_3$  - group is electron pumping in nature which increases the electron density over -COOH group and removal of  $H^+$  ion becomes difficult. Again in



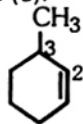
- $OCH_3$  group is electron pumping in nature which again increases electron density over -COOH group hence, acid strength decreases

- 75.(3). All the given compound contains one electron withdrawing group.



contains one electron withdrawing group ( $C_6H_5$ ) but it has two electron pumping group also. That is why this amine will behave as strongest base. - $NO_2$  group is electron withdrawing group in  $O_2N-CH_2-NH_2$  and it does not have electron pumping group. It is primary amine also that is why it will behave as weakest base

76. (1).



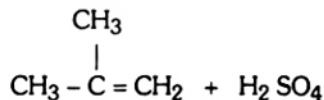
The IUPAC name is  
3-methyl cyclohexene-1-enol  
or 3-methyl cyclohexene

77. (2) Hydrogen bonding is strongest when the bonded structure is stabilized by resonance. The compound of aromatic ring possesses reso-

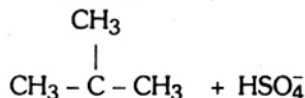
nance, like in phenol. That is why hydrogen bonding in phenol is strongest

- 78.(4). The group -COOH, -CN, -COCH<sub>3</sub> are meta directing. -NHCOCH<sub>3</sub> group is ortho / para directing group

- 79.(2).  $C_6H_6$  reacts in the presence of  $H_2SO_4$  with isobutene as follows

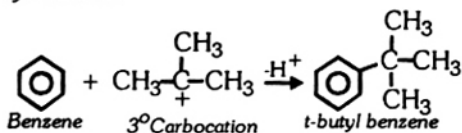


isobutene



tert - carbonium ion

The tertiary carbonium ion (carbocation) reacts with benzene ( $C_6H_6$ ) and gives tert-butyl benzene

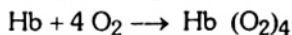


- 80.(4) The most reactive nucleophile among the given compounds is  $(CH_3)_3CO^-$  because  $3^\circ$  alkyl group is strongest electron pumping group. It will pump electron cloud over

$\rightarrow CO^-$  and it will behave as strongest nucleophile

- 81.(2). According to R-S configuration priority rule position 2 is anticlockwise and position 3 is also anticlockwise. Therefore the absolute configuration of the compound is 2s, 3s.

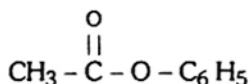
82. (3) One molecule of haemoglobin has four haem groups. Each haem group can co-ordinate with one oxygen molecule ( $O_2$ ). So one haemoglobin can hold four oxygen molecule and becomes oxyhaemoglobin as



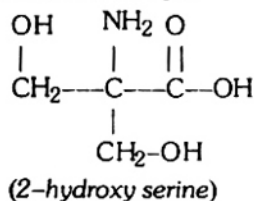
haemoglobin      oxyhaemoglobin

83. (4). At higher temperature  $\text{CH}_3\text{CO}_2\text{C}_6\text{H}_5$  will give iodoform reaction. It is due to the fact that  $\text{CH}_3-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}$ -group gives this test.  $\text{C}_6\text{H}_5-\text{O}-$  will behave as  $\text{C}_6\text{H}_5=\text{O}$ .

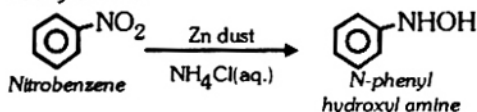
It will release  $-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{CH}_3$  group easily from



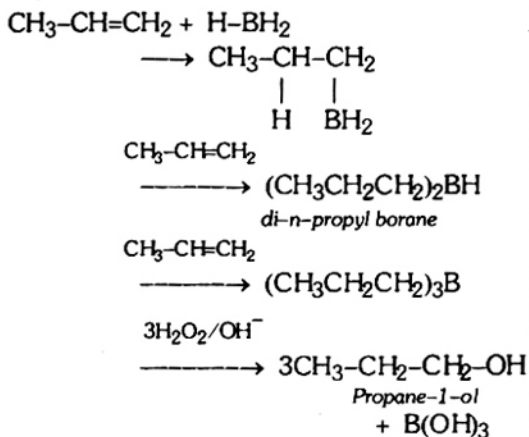
84. (3). 2-Hydroxymethyl serine is an a chiral aminoacid. For chirality all the group attached to carbon atom should be different. But in this case of 2-hydroxymethyl serine, the second carbon atom contain two  $-\text{CH}_2-\text{OH}$  group. hence, achiral. For example



85. (4) Nitrobenzene with Zn dust and aqueous  $\text{NH}_4\text{Cl}$  gives 62–68% yield of N-phenyl hydroxylamine



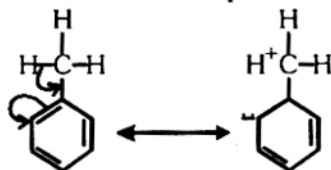
86. (3)



87. (2). The dipole moment of larger halogen with same alkyl group is minimum and with smaller halogen it is maximum. Only exception is fluorine because its electron affinity is less than that of chlorine. So the order of decreasing strength of dipole moment is  $\text{CH}_3\text{Cl} > \text{CH}_3\text{F} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$

88. (2) In  $\text{Na}_2\text{O}$  compound the crystal structure contain CCP in which all tetrahedral site is occupied by  $\text{Na}^+$  ion. Since there are two tetrahedral site per atom, and all the sites are occupied by  $\text{Na}^+$  ions for each  $\text{O}^{2-}$  ion. This structure is known as *antifluorite structure*. Now, one  $\text{Na}^+$  is surrounded by four  $\text{O}^{2-}$  ion, whereas each  $\text{O}^{2-}$  ions surrounded by 8  $\text{Na}^+$  ion. Hence, co-ordination number of  $\text{Na}^+$  is 4

89. Due to resonance and electron withdrawing effect of ring, methyl group pumps electron towards ring and hyperconjugation can be seen in toluene. For example



That is why the bond dissociation energy of C-H is lowest in toluene

90. (4).  $\Delta E = m \Delta T$

where,  $m = 1\text{ g}$ ,  $\Delta T = 6.12\text{K}$  heat capacity of system (S) =  $1.23\text{ kJ/g/degree}$

Now, Heat of decomposition

$$= 1 \times 6.12 \times 1.23 = 7.5276\text{ kJ}$$

$$\text{NH}_4\text{NO}_3 = 7.5276 \times 80$$

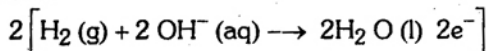
(since mol. wt of  $\text{NH}_4\text{NO}_3 = 80$ )

$$= 602.2\text{ kJ/mol}$$

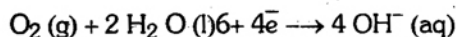
91. (3). Colligative property is a democratic property meaning it depends upon concentration of solute particles. Depression in vapour pressure due to the presence of no volatile solute is also colligative property. Naphthalene is a non-volatile solid, hence its addition in benzene decreases its vapour pressure

92.(3). In the fuel cell chemical energy is directly converted in to electrical energy. Basically fuel cell is a galvanic cell, in which combination of hydrogen and oxygen takes place (combustion) and it produces water or the net reaction is the same as burning of hydrogen and oxygen to form water. The reaction takes place as

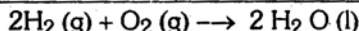
At anode



At cathode

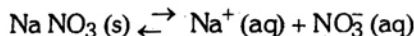


overall



93.(4). The salt solution of weak acid and free acid mixture or solution formed by mixing a weak base with its salt of strong acid are called buffer solution. But  $HClO_4$  is strong acid with its salt  $KClO_4$  it will not behave as buffer solution

94.(3). Standard entropy change  $\Delta S^\circ$  is greater than zero in such cases where number of products are more than the number of reactants for example,



95.(3). The magnetic quantum number (m) deals with the orientation of electron in three dimensional space. i.e., spatial orientation of the orbital

96.(2). The molecule

$CH_3 - (CH_2)_{14} - CH_2 - NH_2$  has both polar  $-NH_2$  and non polar  $-CH_3$  end so it is a surfactant.

97.(2) Form Faraday law of electrolysis

$$Q = It$$

$$I = 9.65 \text{ A. (given)}$$

For deposition of 1 millimole of Al,

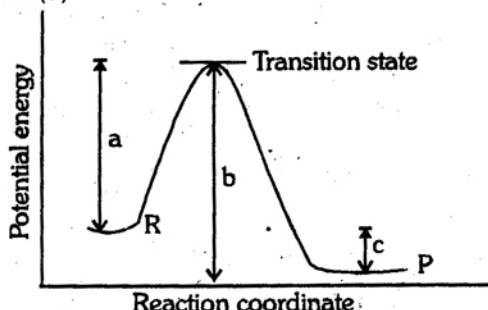
$$Q = \frac{96500}{1000} = 96.5 \text{ Coulomb}$$

$$\text{So, } t = \frac{Q}{I} = \frac{96.5}{9.65} = 10 \text{ sec}$$

98.(2). If the resulting solution is basic at equivalence point then the pH of solution will be greater than 8. It is only possible when weak acid is titrated with strong base. For example.  $CH_3COOH$  when titrated by  $NaOH$

99.(4). Among the given list oxygen is not a green house gas

100. (3)



For forward reaction, activation energy is (2) and for backward reaction the value of activation energy is (1)

$$\text{Therefore, } \Delta H = b - a = c$$

101.(2). The K.E of the Projectile

$$= \frac{1}{2} m v^2$$

And PE Of the Projectile in the earth's gravitational field

$$= \frac{GM_e m}{R_e}$$

where m = mass of the projectile

$M_e$  = mass of the earth

V = Velocity of the projectile

For escape velocity

$$= \frac{1}{2} m v^2 = \frac{GM_e m}{R_e}$$

$$\Rightarrow v^2 = \frac{2GM_e}{R_e}$$

$$= \frac{2GM_e}{R_e} \times \frac{R_e}{R_e}$$

$$= 2 \left( \frac{GM_e}{R_e^2} \right) \times R_e$$

$$= 2 \times g \times R_e$$

Where  $g = \left( \frac{GM_e}{R_e} \right)$

$$\Rightarrow V = \sqrt{2gR_e}$$

Here we see that the velocity of the particle does not depend on the mass of the projectile.

102. (1). The Bernoulli's equation is based on the work-energy theorem of the stream line flow of an ideal fluid. Its statement is as "the total energy per unit volume of a flowing liquid is a constant"

The statement in equation form is as

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

Where P- Pressure on the fluid

$\rho$  = Density of fluid

V = Velocity of fluid

H = Height of the liquid column

103. (4). Because it can be highly focused

Since in surgery we need some very sharply focused beam. So we use laser beam

- 104 (4) Since we know that

$$R = \rho \frac{l}{A}$$

Where  $\rho$  = resistivity of the wire

$l$  = length of the wire

$A$  = Cross section Area of the wire

$$R = \rho \frac{l}{A}$$

$$\Rightarrow \rho = \frac{RA}{l} = \text{constant}$$

$$\therefore \frac{R_1 A_1}{l_1} = \frac{R_2 A_2}{l_2} \text{ --- (1)}$$

Since volume of the wire remained constant

$$\therefore A_1 l_1 = A_2 l_2$$

And  $A_1 = \pi \left( \frac{d}{2} \right)^2 = \pi \frac{d^2}{4}$

$$A_2 = \pi \left( \frac{d}{4} \right)^2 = \pi \frac{d^2}{16}$$

$$\therefore \pi \frac{d^2}{4} \times l_1 = \pi \frac{d^2}{16} l_2$$

given that  $l_1 = L$

$$\therefore \pi \frac{d^2}{4} L = \pi \frac{d^2}{16} l_2$$

$$\Rightarrow l_2 = 4L \text{ --- (2)}$$

Now putting the values of  $l_1$  and  $l_2$  in (1)

$$\frac{R_1 \times \frac{\pi d^2}{4}}{L} = \frac{R_2 \times \frac{\pi d^2}{16}}{4L}$$

$$\Rightarrow \frac{R_1}{4} = \frac{R_2}{16} \times \frac{1}{4}$$

$$\Rightarrow R_1 = \frac{R_2}{16}$$

And  $R_1 = 10 \Omega$

$$\therefore R_2 = 16 \times R_1 \\ = 16 \times 10 = 160 \Omega$$

- 105 (3) Since the energy of the charged particle is

$$= P.D. \times \text{charge}$$

And P.D. =  $\frac{1}{4\pi\epsilon_0} \frac{Q}{r}$

And energy =  $\frac{1}{4\pi\epsilon_0} \frac{Qq}{r}$

$\Rightarrow$  The energy (here K.E.) is independent of mass of the charged particle

- 106 (1) Since the dipole has its torque in an electric field is as

$$\tau = q \times d \times E$$

and force experienced by the charged particle is

$$F = q \cdot E$$

Where  $q$  = charge of the particle

$E$  = electric field

$d$  = separation between the two charges

Here we see that torque and force both will be experienced by the particle

107. (1) For capacitor, impedance is

$$Z_c = \frac{1}{\omega c}$$

And for D.C., we know that

$$w = 0$$

$$Z_c = \frac{1}{0 \times c} = \infty$$

Hence capacitor blocks the D.C. current.  
Hence the current in the circuit becomes instantaneously zero.

108. (2) Gallium has 3 valence electrons  
So it will form the p-type semiconductor

- 109 (3) Since  $N = N_0 e^{-\lambda t}$

$$N = \frac{1}{16} N_0$$

$$\Rightarrow \frac{1}{16} N_0 = N_0 e^{-\lambda t}$$

$$\Rightarrow \frac{1}{16} = e^{-\lambda t}$$

$$= e^{\frac{-\ln 2}{T_{1/2}} t}$$

taking  $\log_e$  on both sides

$$\log_e 1 - \log_e 16 = \frac{-\log 2}{T_{1/2}} \times t \times \log_e e$$

$$\Rightarrow 0 - 2.77 = - \frac{0.693 \times 40}{T_{1/2}}$$

(Because  $t=40$ )

$$\therefore T_{1/2} = \frac{0.693 \times 40}{2.77} = \frac{27.72}{2.77} = 10 \text{ days}$$

- 110 Let the K.E of neutron

$$= \frac{1}{2} m_n \times V^2$$

Deuteron has one proton and one neutron.  
So this energy will be distributed among all the three particles as one coming neutron and two deuterons constituent particles. So the K.E. of the coming neutron has now

$$\frac{1}{2} m_n V^2 \times \frac{1}{3}$$

$$= \frac{1}{6} m_n V^2$$

Loss of K.E.

$$= \frac{1}{2} m_n V^2 - \frac{1}{6} m_n V^2$$

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

Here let  $m_n = m_r$

$\therefore$  Fraction loss of K.E. is.,

$$\frac{\frac{1}{3} m_n V^2}{\frac{1}{2} m_n V^2} = \frac{1}{3} m_n V^2 \times \frac{2}{m_n V^2} = \frac{2}{3}$$

So the answer will be  $\frac{2}{3}$

111. The motion of planetary motion is based on the Kepler's laws of planetary motion.

And the Kepler's laws of planetary motion is based on the conservation of angular momentum

- 112.(1) Since we know that surface energy due to the surface tension

= Surface tension  $\times$  surface area

$$\therefore E_1 = s_1 \times T$$

$$E_2 = s_2 \times T$$

{ Because of the surface tension of the same liquid in same }

$$\therefore \frac{E_1}{E_2} = \frac{s_1 \times T}{s_2 \times T} = \frac{S_1}{S_2}$$

$$\Rightarrow \frac{E_1}{E_2} = \frac{1}{(2)^{1/3}} = 1:2^{1/3}$$

113. (3) From the Stefan's formula we know that the heat radiated =  $\sigma \times T_4$

$$\Rightarrow u_1 = \sigma(T_1)^4$$

$$u_2 = \sigma(T_2)^4$$

$$T_1 = 227 + 273 = 500$$

$$T_2 = 273 + 727 = 1000$$

$$\therefore \frac{u_1}{u_2} = \frac{\sigma \times (500)^4}{\sigma \times (1000)^4} = \frac{1}{16}$$

But  $u_1 = 20 \text{ cal m}^{-2} \text{ s}^{-1}$



$$\therefore u_2 = 16 \times 4$$

$$= 16 \times 20 = 320 \text{ cal m}^{-2} \text{ s}^{-1}$$

114. (3) The effective spring constant

$$K = K + 2K + 3K$$

Since the time period of oscillation

$$T = 2\pi \sqrt{\frac{M}{K}}$$

And  $T = \frac{1}{f}$

Where  $f$  = frequency of oscillation

$$\Rightarrow \frac{1}{f} = 2\pi \sqrt{\frac{M}{K}}$$

$$\therefore f = \frac{1}{2\pi} \sqrt{\frac{K}{M}}$$

$$\Rightarrow f = \frac{1}{2\pi} \sqrt{\frac{3K}{M}}$$

$$\therefore f = \frac{1}{2\pi} \sqrt{\frac{3k}{m}}$$

115. (2) Since  $X \times p_x = \text{constant}$

From the de-Broglie hypothesis

$$P = \frac{h}{\lambda}$$

$$\Rightarrow X \times \frac{h}{\lambda} = \text{constant}$$

$$\Rightarrow \frac{X}{\lambda} = \frac{\text{constant}}{h} = \text{constant}$$

$$\Rightarrow x = \lambda \times \text{constant}$$

$$\Rightarrow x \propto \lambda$$

So for the maximum accuracy the value of  $\lambda$  should we longer

116 (3) The shift is

$$(\mu - 1) \lambda$$

And the shift of maxima is  $n\lambda$

$$\Rightarrow (\mu - 1) \times t = n\lambda$$

Where  $\mu$  = refractive index of thin film

$t$  = thickness of thin film

$\lambda$  = wavelength of the light

here  $\mu = 1.5$ ,  $t = 2 \mu\text{m} = 2 \times 10^{-6}$

$$\lambda = 500 \text{ nm} = 500 \times 10^{-9} \text{ m}$$

$$\therefore (1.5 - 1) \times 2 \times 10^{-6}$$

$$= n \times 500 \times 10^{-9}$$

$$\Rightarrow 0.5 \times 2 \times 10^{-6} = n \times 500 \times 10^{-9}$$

$$n = \frac{0.5 \times 2 \times 10^{-6}}{500 \times 10^{-9}}$$

$$= \frac{1}{500} \times 10^{-6+9}$$

$$= \frac{1}{500} \times 10^3$$

$$= \frac{1000}{500} = 2$$

So the central maxima will shift upward by two fringes

117(2)

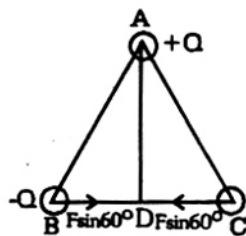
Since  $\lambda = \frac{h}{p}$

$$\Rightarrow \lambda \propto \frac{1}{p}$$

So the de-Broglie wavelength changes according to the momentum and vice-versa.

118 (2) Since the X-ray is produced due to the transition of electrons from higher electronic orbit to the lower electronic orbit.

119 (1)



Net force along AD

$$= F \sin 60^\circ - F \sin 60^\circ = 0$$

120 (1)  $\therefore C = 2\mu F = 2 \times 10^{-6} \text{ F}$

$$f = 1 \text{ KHz} = 1 \times 10^3 \text{ Hz}$$

$$I = 2 \text{ mA} = 2 \times 10^{-3} \text{ A}$$

Impedance

$$Z_c = \frac{1}{\omega C} = \frac{1}{2\pi f \times C}$$

$$= \frac{1}{2\pi \times 10^3 \times 2 \times 10^{-6}}$$

$$= 79.57 \Omega$$

Now

$$V = I \times R$$

$$= 2 \times 10^{-3} \times 79.57 \approx 0.16V$$

121. (2) Since we know that the magnetic induction of the centre of a circular conducting loop of radius  $r$  is

$$B = \mu \frac{n i}{2r}$$

In this case,  $n = 1, r = 5 \times 10^{-2} \text{m}$

$$\mu_0 = 4\pi \times 10^{-7}$$

$$B = 0.5 \times 10^{-5} \text{ Wb/m}^2$$

$$\begin{aligned} \therefore i &= \frac{B \times 2r}{\mu \times n} \\ &= \frac{0.5 \times 10^{-5} \times 2 \times 5 \times 10^{-2}}{4\pi \times 10^{-7} \times 1} \\ &\approx 0.39 \approx 0.4 \text{ A} \end{aligned}$$

122. (3) Due to the ferromagnetic material

Actually the dipoles are getting polarised. So it gets some net dipole moment, And due to the net dipole moment the magnetic field induces: And this causes the deflection in the electric field

- 123(3) From the Weins displacement law we know that  $\lambda_{\text{max}} T = \text{constant}$ .

So the plot between  $I$  and  $\lambda$  should be symmetrical. But due to the catastrophe of the black radiation, if temperature increases wavelength having maximum intensity shifts towards left.

- 124 (4) From Gauss's law

$$\phi = \int \vec{E} \cdot d\vec{s}$$

Here

$$ds = +q - q = 0$$

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

125. (4) Since we know that

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

So as  $v$  increases  $u$  decreases continuously

- 126 (1) It happens only between the two light nuclei. Actually in heavy nuclei, the nucleus can not come close and contact.

127. (2) From Lorentz force law we know that

$$\vec{F} = e (\vec{v} \times \vec{B})$$

$$\vec{v} = \hat{i} v_x \times \vec{B} = B_y \hat{i}$$

$$\therefore \vec{F} = e [v_x \hat{i} \times B_y \hat{j}]$$

$$= e v_x B_y (\hat{k})$$

So the place is in x-Z plane

And we know that in the magnetic field, the charge particles makes circular motion.

- 128 (2) 4 min.

$$129 (3) \quad v_2 = u^2 + 2as$$

$$= 0 + 2as = 2as$$

$$\Rightarrow v \propto \sqrt{s}$$

$$\Rightarrow v \text{ is increasing as } s \text{ is increasing}$$

- 130 (2) The loop is attracted towards the  $i_2$ . Actually the direction of current  $i$ , which is near to the wire  $i_2$  in parallel. And parallel current attracts.

Again the current  $i_1$  is also flowing in opposite direction to  $i_2$  but it is far away from  $i_2$ . So this force is less in comparison to that force.

So that the loop is attracted towards the  $i_2$

131. (4) In going upwards the velocity decreases because  $v = u - gt$

Again in coming downward, the vel increases because  $V = u + gt$

so the curve should like (3) But due to the air resistance it not the sharp

132. (3) The radio active nuclei that are injected into a patient collects a certain sites with in its body and after radioactive decay it emits e.m. radiations. The e.m. radiations are detected by the detector. The process of diagnostic is called radiotracer techniques

133. (2) P.E.T.

It is called Pair Emission Technique when the electron and positron combine together to liberate energy as a  $\gamma$ -ray, then that form of diagnostic process is called Pair Emission Technique

$$134.(3) \text{ Since } R = 1.22 \frac{\lambda \times D}{a}$$

Where  $R$  = resolution  
 $\lambda$  = wavelength  
 $D$  = attitude of astronaut  
 $a$  = Pupil diameter  
 $\lambda = 500\text{nm} = 500 \times 10^{-9}\text{m}$   
 $a = 5\text{mm} = 5 \times 10^{-3}\text{m}$   
 $D = 400\text{Km} = 400 \times 10^3\text{m}$

$$\therefore 1.22 \times \frac{500 \times 10^{-9} \times 400 \times 10^3}{5 \times 10^{-3}}$$

$$= 48.8\text{m} \approx 50\text{m}$$

135 (3) Since, the time difference  
 $= 4\text{ min} = 4 \times 60 = 240\text{ sec}$

$$\therefore s = v \times t = 4.5 \times t$$

Again  $S = 8 \times (t - 240)$

$$\therefore 4.5 \times t = 8(t - 240)$$

$$= 8t - 8 \times 240$$

$$\Rightarrow -3.5t = -8 \times 240$$

$$\therefore t = \frac{8 \times 240}{3.5} = 548\text{ sec}$$

Since the min vel in 4.5 km/s.

So the minimum distance it will cover in

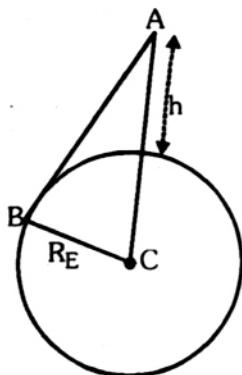
$$4.5 \times t = 4.5 \times 548\text{km}$$

$$= 2466\text{km} \approx 2500\text{km}$$

136. (1) Glycerine is a liquid

so when the lead goes inside than it has some velocity. After some time it acquires the terminal velocity and becomes constant

137. (1) Let the height of TV antenna =  $X$   
 and radius of earth =  $R_E$



A = top point of tower

B = the point of receiving station

Now

$$AC^2 = AB^2 + BC^2$$

$$(R_E + h)^2 = AB^2 + R_E^2$$

$$\Rightarrow R_E^2 + h^2 + 2R_E \cdot h = AB^2 + R_E^2$$

$$\Rightarrow AB^2 = h^2 + 2R_E \cdot h$$

Since  $h^2 \ll R_E$

$$\therefore AB^2 = 2R_E \cdot h$$

$$\therefore AB = \sqrt{2R_E \cdot h}$$

138. (1) Since reflected frequency

$$= 9 \cdot n^{1/2}$$

Where  $n$  = electron density =  $10^{11}$

$$= 9 \times (10^{11})^{1/2}$$

$$= 9 \times (10^{10} \times 10)^{1/2}$$

$$= 9 \times \sqrt{10} \times 10^5$$

$$= 9 \times 3.16 \times 10^5$$

$$= 28 \times 10^5$$

$$= 2.8 \times 10^6 = 2.8\text{ MHz}$$

139 (3) Out put voltage

$$= B \times \text{Input Voltage}$$

$$= 100 \times 10^{-2} = 1\text{V}$$

140 (3)

$$\therefore F = \frac{\mu}{4\pi} \times \frac{m_1 m_2}{r^2}$$

$$\therefore \mu = \frac{F \times r^2}{m_1 m_2}$$

Where  $m_1$  and  $m_2$  are the magnetic strength.

$$\Rightarrow \mu = \frac{\text{MLT}^{-2} \times \text{L}^{-2}}{(\text{AL}) \times (\text{AL})} = \text{MLT}^{-2} \text{A}^{-2}$$

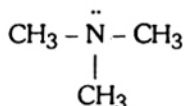
141. Allergic reaction develop in response to histamine released by mast cells. This allergic reaction is triggered by cross linking of IgE molecule on the surface of mast cells by an allergen. These histamines released by mast cells initiate inflammatory response which trigger the arrival of leukocyte at the site of allergen or infection.

142. Indian soils are found deficient in nutrients like nitrogen, phosphorus and potash. Maximum yield can be achieved by using fertilizer rich in these nutrients.  
Water is an essential component of vital activities in plant.  
So both fertilizer and irrigation are important for high yield
143. BMR or Basic Metabolic Rate is inversely related to weight and volume of an organism i.e. small the organism higher is BMR  
Heart rate of a six month old baby is 110 to 112 beats/min. Whereas old aged person may have max. heart rate of 160 beats/min.
144. Four chambered heart is also present in some reptiles. Bats and whales though have 4 chambered heart but also possess other mammalian characters like milk gland, pinnae, hairs on the body, presence of diaphragm etc.
145. SARS was first reported (WHO) in China. The high population in China is not directly responsible for the origin of SARS  
The killer pneumonia virus (a type of corona virus) is responsible for SARS origin.
146. Organochlorides are organic compounds that have been chlorinated and have very low biodegradation and gets accumulated in environment. e.g. DDT, BHC etc.  
Fenitrothion is organophosphate pesticide which are organic ester of phosphoric acid and its derivative. Though they are toxic but are biodegradable.
147. In eggs of Amphioxus and eutherian mammals including rabbit and man holoblastic cleavage takes place. The holoblastic cleavage produces blastomeres of equal size.  
Centrolecithal eggs are found in insects and in some hydrozoa. Meroblastic cleavage occurs in them.
148. Noise level upto 60 dB (decibel) is well tolerated. Whereas jet sounds upto 150–160 dB. But jet aeroplanes normally do not land in common airports without an emergency.
149. Koel and cuckoo need not build nest because they use nest of other birds and incubate their eggs and nurture hatchlings of these birds (Crows). In this way they are nest parasites. Tailor bird is a garden bird which makes its nest by sewing and has no relations (direct) with koel or cuckoo.
150. As a result of ageing or senescence there is a progressive deterioration in structure and function of body tissue and organs. Immune system is no more effective and chances of illness increases. Cessation by mitosis is not a genetically programmed event
151. Fluid mosaic model was given by S. J. Singer and G. L. Nicolson (1970). Proteins float in a bilipid layer according to bilipid membrane model.
152. Embryoids or somatic embryo has the ability to form full fledged plant. (Cellular totipotency)
153. Anthocyanin pigment are present in cell sap of vacuole. These are colouring pigment of certain higher plants that impart reddish and greenish colour. It is not a photosynthetic pigment.
154. Apoplastic movement : Pertaining to the movement of water in free space of tissue; free space includes cell walls and intercellular space. Through root hair to endodermis water moves through apoplasts. But in the case of endoderms which has suberised and partially cutinised wall obstructing the passage of water to xylem vessels. From here water moves by symplasm.
156. Some trees like oak, elm, mountain cedar etc. produces allergic pollen grains which may cause sneezing, itching in eyes and nose etc.  
Conifers produce large quantity of wind borne pollen grains because many pollen grains are destroyed in the process of pollination by wind.
157. Fermentation is used in baking therefore yeasts the agent of fermentation are used in baking industries
158. Number of organisms at any trophic level depends upon the availability of food. In grassland ecosystem the maximum number of organism are found in lower trophic level but in forest ecosystem and parasitic food chain it is reverse.
159. Tropical rain forests are very rich in biodiversity

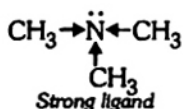
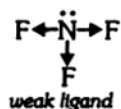
160. By adopting mimicry butterflies blend with the surroundings and protect themselves from enemies

161. (1) Due to the oxidation state of chromium (+6) in  $\text{Na}_2\text{CrO}_4$  it is intensely coloured

162.(3).  $\text{NF}_3$  is weak ligand than

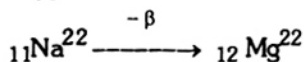


because fluorine is strong electronegative element which withdraws the electron cloud of nitrogen atom and hence, its tendency to co-ordinate its lone pair of electron decrease, whereas  $(\text{CH}_3)_3\text{N}$  is strong ligand because it has three electron pumping group i.e.,  $-\text{CH}_3$  group, which increases the electron cloud over nitrogen and makes this molecule to strong ligand as it can easily co-ordinate its lone pair of electrons

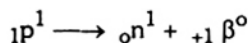


163.  $\text{PbI}_4$  is not a stable compound because Pb shown (II) oxidation state more frequently only some times due to *inert pair effect* it shows + (IV) oxidation state. Secondly iodine cannot stabilize higher oxidation state

164. Due to one  $\beta$  particle emission this change happens



Again proton emission convert proton in to neutron



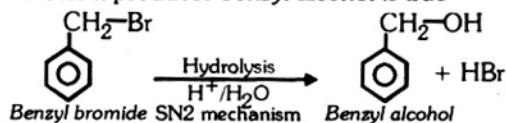
165.(2). Barium is not required for normal biological functions is true statement, again, barium shows only +2 oxidation state not variable oxidation state is also true.

But this explanation for the no requirement of barium in normal biological function is not true

166.(3). The haemoglobin is oxygen carrier as in oxyhaemoglobin  $\text{Hb}(\text{O}_2)_4$  is true but  $\text{O}_2$  does not binds as  $\text{O}_2^-$  with Fe. Most appropriately we can say oxygen binds as  $\text{O}_2$  to Fe of heme part

167.(4). Glycosides can be prepared by treating glucose with  $\text{CH}_3 - \text{OH}$  in the presence of dry  $\text{HCl}$  gas. They can not be hydrolysed in acidic medium. They are hemiacetals and not acetals.

168.(1) Benzyl bromide when kept in acetone water it produces benzyl alcohol is true



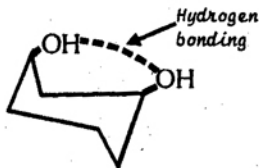
169.(2) Activity of enzyme is pH dependent, it is true. The change in pH affects the solubility of the enzyme in water is also true but this is not the correct explanation of activity of enzyme based on pH

170.(2). It is true that alkyl benzene can not be prepared by Friedel crafts alkylation of benzene. It is due to the fact that monoalkyl product formed undergo alkylation to form poly alkylated benzene. Reason is true that alkyl halide is less reactive than acyl halides but this is no the explanation of assertion

171. (1) Both the assertion and reason are true and explain each other because Grignard reagents reacts with hydroxyl group of hydroxyketone that is why hydroxy ketone are not used directly in Grignard reagent

172.(3). It is true that trans-2-butene on reaction with  $\text{Br}_2$  gives meso -2, 3- dibromobutane. But this reaction does not involves syn-addition of bromine

173.(4). cis-1, 3-dihydroxy cyclo hexane exist in chair form of conformation

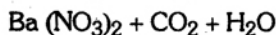


There is hydrogen bonding between the two hydroxyl group

$\text{H}_2\text{O}_2$ .  $\text{H}_2\text{O}_2$  is non ionic compound. Both the assertion and reason in this question is wrong.

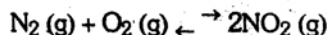
174.(1) For all isothermal process internal energy,  $\Delta E = 0$ , it is true. That is why  $\Delta E$  for vapourisation of one mole of water at 1 atm. and 373 K is zero

175.(1)  $\text{BaCO}_3 + 2 \text{HNO}_3 \longrightarrow$



Because  $\text{BaCO}_3$  is weak base and reacts with  $\text{H}^+$  ion of nitric acid and due to this its salt ( $\text{BaCO}_3$ ) dissociated in  $\text{HNO}_3$ . Where as water does not have such type of strong  $\text{H}^+$  ions.

176.(2). For the reaction



$\Delta H$  and  $\Delta E$  are almost same, it is true. It is also true that all products and reactants are gases but its not correct explanation

177.(2). Photo chemical smog is produced by nitrogen oxide, it is true. But it is natural phenomenon, however, it has been accelerated by vehicular pollution but it is not correct explanation of photo chemical smog.

178.(3). Freezing point decreases at high pressure on pure water is true. But the density of water is maximum at  $4^\circ\text{C}$  i.e.,  $273+4 = 277 \text{ K}$

179.(2). Micelle formed by Na-Stearate in water has  $-\text{COO}^-$  group at the surface is true. It is also true that surface tension of water is reduced by the addition of stearate but it is not correct explanation of micelle formation. Micelle is formed if molecules with polar and non polar end assemble in bulk to give non-polar interior and polar exterior

180.(4). In  $\text{F}_2\text{O}_2$ , O-O bond length is shorter as compare to O-O bond length of

181(1) Temperature near the sea coast is moderate. Because the water heats up and cools down very slowly. So the thermal conductivity generally does not take place.

182.(4) According to classical calculations, the earth is not slowing down. It moves with constant velocity. Again the angular momentum is also conserve. because  $K = r \times p$

So both the statements are wrong.

183.(1) The tube emits white light due to the fluorescence. and this phenomenon takes place at very low pressure at 0.01 mm Hg.

But not at high temperature

184.(3) The  $\beta^-$  particles emitted by the radio nuclei. The  $\beta^-$  emission takes place due to the conversion of neutron into proton. It does not take place due to the presence of electron inside the nucleus.

185.(2) The resistivity of the semiconductor decreases with increase of temp. the atoms of a semiconductor vibrate with larger amplitudes at higher temp. there by increasing its conductivity not resistivity.

186.(3) The gravitational force is more dominant in the nature. This the the cause of the stability of the planetary motion.

187 The earth is not slowing down due to conservation of angular momentum.

188.(1) These are the Bohrs postulates

189.(1) This happens due to the induction produced in the wire.

since  $E = L \frac{dI}{dt}$ , so if  $\frac{dI}{dt}$  changes, E changes and it causes the fusing.

190.(2) This happens due to the variation of density of the different layers of the air. Again the intensity of light on our eye is very small in comparison to the planets. So this happens

But the size of star giving no affect at all.

191.(1) It is really used in the treatment

192.(1) Both the statement are true.

When a beetle disturbs the sand, it sends pulses of along the sand surface one set of pulses is fast longitudinal and the other will be slower transverse.

193.(2) This happens due to the fact that the pressure inside the bottle is large in comparison to the outside. So the adiabatic expansion takes place And due to the lowering of temperature the gas condenses and vapour forms.

194.(3) This happens due to the reduction of the pressure

Again the material of the balloon can be easily stretched

195.(1) Owls can move freely during night because it has a large no of rods on their retina

196.(1) Due to the thermal radiation light moves up. So the temperature at the upper part is more than the temperature at lower point.

197.(4) Since,  $f = \frac{1}{2\pi} \sqrt{\frac{g}{e}}$

So the  $f$  does not depend on time and remaining constant

198.(4) As we know that the information carrying capacity is directly proportional to the band width. So that wider the band width greater the information carrying capacity.

199.(2) Neutron can penetrate easily in to the matter because it does not has the charge. So the Coulomb repulsion does not take place Again its size is slightly large

200.(2) This happens due to the fact that the earth is a magnet. So the deflection of the charged particle at the polar region takes place.