BIOLOGY

1. Which one, of the following statements about all the four *of Spongilla,* Leech, Dolphin and Penguin*is correct.*
   (1) *Spongilla* has special collared cells called choanocytes, not found in the remaining three
   (2) All are bilaterally symmetrical
   (3) Penguin is homoiothermic while the remaining three are poikilothermic
   (4) Leech is a fresh water form while all others atemaririe

Ans. (1)

2. Which one of the following statements about human'sperm incorrect?
   (1) Acrosome servesas a sensory structure leading the sperm towards the ovum
   (2) Acrosome serves no particular function.
   (3) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
   (4) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation

Ans. (4)

3. The nerve centres which control the body temperature and the urge for eating are contained in
   (1) Cerebellum
   (2) Thalamus
   (3) Hypothalamus
   (4) Pons

Ans. (3)

4. What is true about RBCs in humans ?
   (1) They frarisport about 80 per cent oxygen pnly and the rest; 20 per cent of it is transported in dissolved state in blood plasma
   (2) They do not carry CO_2 at all
   (3) They carry about 20–25 per cent of CO_2
   (4) They do not carry CO_2 at all They carry about 20-25 per cent of CO_2 They transport 99.5 percent of O_2

Ans. (3)

5. Which one of the following is used as vector for cloning genes into higher organisms?
   (1) Rhizopus nigriccans
   (2) Retrovirus
   (3) Baculovirus
   (4) *Salmonella typhimurium*

Ans. (2)

6. Select the two corret statements out of the four (a–d) given below about lac operon.
   (1) Glucose or galactose may bind with the repressor and inactivate it
   (2) Inthe absence of lactose the repressor binds with the operatorregion
   (3) The z-gene codes for permease
   (4) This was elucidated byFrancois Jacob and Jacque Monod

Ans. (1)

7. The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons ?
   (1) Aleurone layer
   (2) Plumule
   (3) Cotyledons
   (4) Endosperm

Ans. (3)

8. Ringworm in humans is caused by:
   (1) Nematodes
   (2) Viruses
   (3) Bacteria
   (4) Fungi

Ans. (4)

9. The technical term used for the androecium in a flower of China rose *(Hibiscus rosasinensis)* is:
   (1) Polyandrous (2) Polyadelphous
   (3) Monadelphous (4) Diadelphous

Ans. (3)

10. Which one of the following is an example of *ex-situ* conservation ?
    (1) Sacred groves
    (2) National park
    (3) Wildlife sanctuary
    (4) Seed bank

Ans. (4)

11. Wind pollinated flowers are:
    (1) large producing abundant nectar and pollen
    (2) small, producing nectar and dry pollen
    (3) small, brightly coloured, producing large number of pollen grains
    (4) small, producing large number of dry pollen grains

Ans. (4)

12. Keel is characteristic of the flowers of:
    (1) *Calotropis*
    (2) Bean
    (3) Gulmohur
    (4) *Cassia*

Ans. (2)

13. The biomass available for consumption by the herbivores and the decomposers is called:
    (1) Standing crop
    (2) Gross primary productivity
    (3) Net primary productivity
    (4) Secondary productivity

Ans. (3)

14. Seminal plasma in human males is rich in:
    (1) DNA and testosterone
    (2) ribose and potassium
    (3) fructose and calcium
    (4) glucose and calcium

Ans. (3)

15. The principal nitrogenouse excretory compound in humans is synthesised:
    (1) in liver and also eliminated by the same through bile
    (2) in the liver, but eliminated mostly through kidneys
    (3) in kidneys but eliminated mostly through liver
    (4) in kidneys as well as eliminated by kidneys

Ans. (2)

16. Darwin's finches are a good example of:
    (1) Adaptive radiation
    (2) Convergent evolution
    (3) Industrial melanism
    (4) Connecting link

Ans. (1)

17. Which one of the following statements about morula in humans is *corect*?
    (1) It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote
    (2) It has more cytoplasm and more DNA than an uncleaved zygote
    (3) It has almost equal quantity of cytoplams as an uncleaved zygote but much more DNA
    (4) It has far *less* cytoplasm as well as *less* DNA than in an uncleaved zygote

Ans. (3)

18. An element playing important role in nitrogen fixation is:
    (1) Manganese (2) Zinc
    (3) Molybdenum (4) Copper

Ans. (3)

19. The two gases making highest relative contribution to the greenhouse gases are:
    (1) CFC_5 and N_2O (2) CO_2 and N_2O
    (3) CO_2 and CH_4 (4) CH_4 and N_2O

Ans. (3)

20. Toxic agents present in food which interfere with thyroxine synthesis lead to the development of:
    (1) simple goitre (2) thyrotoxicosis
    (3) toxic goitre (4) cretinism

Ans. (1)

21. In unilocular ovary with a single ovule the placentation is:
    (1) Free Central (2) Axile
    (3) Marginal (4) Basal

Ans. (4)

22. Apomictic embryos in *citrus* arise from:
    (1) Antipodal cells
    (2) Diploid egg
    (3) Synergids
    (4) Maternal sporophytic tissue in ovule

Ans. (4)

23. Which one of the following has its own DNA?
    (1) Lysosome (2) Peroxisome
    (3) Mitochondria (4) Dictyosome

Ans. (3)

24. The kind of epithelium which forms the inner walls of blood vessels is:
    (1) ciliated columnar epithelum
    (2) squamous epithelium
    (3) cuboidal epithelium
    (4) columnar epithelium

Ans. (2)

25. Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called:
(1) Karyogamy (2) Autogamy
(3) Xenogamy (4) Gitnogamy

Ans. (4)

26. The second maturation division of the mammalian ovum occurs:
(1) Until the nucleus of the sperm has fused with that of the ovum
(2) in the Graafian follicle following the first maturation division
(3) Shortly after ovulation before the ovum makes entry into the Fallopian tube
(4) Until after the ovum has been penetrated by a sperm

Ans. (4)

27. Which one of the following is *not* used in organic farming?
(1) *Oscillatoria* (2) Snail
(3) *Glomus* (4) Earthworm

Ans. (1)

28. Which two of the following changes (a-d) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more)?
(a) Increase in red blood cell size
(b) Increase in red blood cell production
(c) Increased breathing rate
(d) Increase in thrombocyte count

Changes occurring are:
(1) (a) and (d) (2) (a) and (b)
(3) (b) and (c) (4) (c) and (d)

Ans. (3)

29. A renewable exhaustible natural resource is:
(1) Minerals (2) Forest
(3) Coal (4) Petroleum

Ans. (2)

30. Slect the correct statement from the following :
(1) Biogas commonly called gobar gas, is *pure* methane
(2) Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria
(3) Biogas is produced by the activity of aerobic bacteria on animal waste
(4) *Methanobacterium* is an aerobic bacterium found in rumen of cattle

Ans. (2)

31. The permissible use of the teachnique amniocentesis is for:
(1) transfer of embryo into the uterus of a surrogate mother
(2) detecting any genetic abnormality
(3) detecting sex of the unborn foetus
(4) artificial insemination

Ans. (2)

32. The main arena of various types of activities of a cell is:
(1) Cytoplasm (2) Nucleus
(3) Plasma membrane (4) Mitochondrian

Ans. (1)

33. Phototropic curvature is the result of uneven distribution of:
(1) Cytokinins (2) Auxin
(3) Gibberellins (4) Phytochorme

Ans. (2)

34. Listed below are four respiratory capacities (a-d) and four jumbled respiratory volumes of a normal human adult:

	Respiratory capacities	Respiratory volumes
(a)	Rsidual volume	2500 mL
(b)	Vital capacity	3500 mL
(c)	Inspiratory reserve	1200 mL
(d)	Inspiratory capacity	4500 mL

Shich one of the following is the *correct* matchign of two capacities and volumes?
(1) (d) 3500 mL (a) 1200 mL
(2) (a) 4500 mL (b) 3500 mL
(3) (b) 2500 mL (c) 4500 mL
(4) (c) 1200 mL (d) 2500 mL

Ans. (1)

35. The signals for parturition originate from:
(1) Oxytocin released from maternal pituitary
(2) fully developed foetus only
(3) placenta only
(4) placenta as well as fully developed foetus

Ans. (4)

36. Select the *correct* statement from the ones given below with respect to dihybrid cross
(1) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones

(2) Tightly linked genes on the same chromosome show very few recombinations

(3) Tightly linked genes on the same chromosome show higher recombinations

(4) Genes far apart on the same chromosome show very few recombinations

Ans. (2)

37. Restriction endonucleases are enzymes which:

(1) restrict the action of the enzyme DNA polymerase

(2) remove nucleotides from the ends of the DNA molecule

(3) make cuts at specific positions within the DNA molecule

(4) recognize a specific nucleotide sequence for binding of DNA ligase

Ans. (3)

38. The part of Fallopian tube closest to the ovary is:

(1) Cervix (2) Ampulla

(3) Isthmus (4) Infundibulum

Ans. (4)

39. ABO blood groups in humans are controlled by the gene I. It has three alleles-A^A, I^B and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur?

(1) Four (2) Two

(3) Three (4) One

Ans. (1)

40. dB is a standard abbreviation used for the quantitative expression of

(1) the dominant *Bacilus* in a culture

(2) a certain pesticide

(3) the density of bacteria in a medium

(4) a particular pollutant

Ans. (4)

41. The one aspect which is *not* a salient feature of genetic code, is its being:

(1) Universal (2) Specific

(3) Degenerate (4) Ambiguous

Ans. (4)

42. The genotype of a plant showing the dominant phenotype can be determined by:

(1) Pedigree analysis (2) Back cross

(3) Test cross (4) Dihybrid cross

Ans. (3)

43. Which one of the following *does not* follow the central dogma of molecular biology?

(1) *Chlamydomonas* (2) HIV

(3) Pea (4) *Mucor*

Ans. (2)

44. Consider the following four statements (a-d) regarding kidney transplant and select the *two correct* ones out of these.

(a) Even if a kidney transplant is proper the recipient may need to take immuno-suppresants for a long time

(b) The cell-mediated immune response is responsible for the graft rejection

(c) The B-lymphocytes are responsible for rejection of the graft

(d) The acceptance or rejection of a kidney transplant depends on specific interferons

The two *correct* statements are:

(1) (a) and (c) (2) (a) and (b)

(3) (b) and (c) (4) (c) and (d)

Ans. (2)

45. An improved variety of transgenic basmati rice:

(1) is completely resistant to all insect pests and diseases of paddy

(2) gives high yield but has no characterisitic aroma

(3) does not require chemical fertilizers and growth hormones

(4) gives high yield and is rich in vitamin A

Ans. (4)

46. Heartwood differs from sapwood in:

(1) Having dead and non0conducting elements

(2) Being susceptible to pests and pathogens

(3) Presence of rays and fibres

(4) Absence of vessels and parenchyma

Ans. (1)

47. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by sonie particular restriction enzyme?

(1) 5'-----GAATTC------3'
3'-----CTTAAG------5'

(2) 5'-----GACGTA------3'
3'-----GTCAGT------5'

(3) 5'-----CGTTCG------3'
3'-----ATGGTA------5'

(4) 5'-----GATATG------3'
3'-----CTACTA------5'

Ans. (1)

48. DNA or RNA segment tagged with a radioactive molecule is called:
(1) Clone (2) Plasmid
(3) Vector (4) Probe

Ans. (4)

49. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy>
(1) Sixth month (2) Third month
(3) Fourth month (4) Fifth month

Ans. (4)

50. Which one of the following is *not* a micronutrient?
(1) Zinc (2) Boron
(3) Molybdenum (4) Magnesium

Ans. (4)

51. PGA as the first CO_2 fixation product was discovered in photosynthesis of:
(1) Angiosperm (2) Alga
(3) Bryophyte (4) Gymnosperm

Ans. (2)

52. Single-celled eukaryotes are included in:
(1) Archaea (2) Monera
(3) Protista (4) Fungi

Ans. (3)

53. Which one of the following symbols and its representation, used in human pedigree analysis is *correct*?
(1) □ = unaffected female
(2) ◆ = male affected
(3) □═○ = mating between relatives
(4) ○ = unaffected male

Ans. (3)

54. Which stages of cell division do the following figures A and B represent resectively?

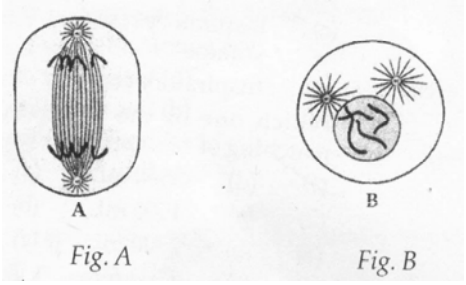


Fig. A Fig. B

(1) Late Anaphase - Prophase
(2) Prophase - Anaphase
(3) Mataphase - Telophae
(4) Telophase - Metaphase

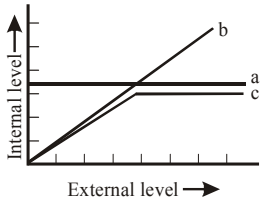
Ans. (1)

55. Study the four statements (a-d) given below and select the two *Correct* ones our of them :
(a) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
(b) Predator star fish *Pisaster* helps in main taining species diversity of some inverte brates
(c) Predators ultimately lead to the extinction of prey species
(d) Production of chemicals such as nicotine, strychnine by the plants are metabolic dis orders

The two correct statements are :
(1) (a) and (d) (2) (a) and (b)
(3) (b) and (c) (4) (c) and (d)

Ans. (2)

56. The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively ?



(1) partial regulator conformer regulator
(2) regulator conformer partial regulator
(3) conformer regulator partial regulator
(4) regulator partial conformer regulator

Ans. (2)

57. Ovary is half-inferior in the flowers of :
(1) Brinjal (2) Cucumber
(3) Guava (4) Plum

Ans. (4)

58. Male and female gametophytes are independent and free-living in :
(1) *Pinus* (2) *sphagnum*
(3) Mustard (4) Castor

Ans. (2)

59. Photoperiodism was first characterised in :
(1) Tomato (2) Cotton
(3) Tobacco (4) Potato

Ans. (3)

60. Injury to adrenal cortex is not likely to affect the secretion of which one of the following ?
(1) Adrenaline
(2) Cortisol
(3) Aldosterone
(4) Both Androstenedione and Dehydroepiandrosterone

Ans. (1)

61. Coiling of garden pea tendrils around any support is an example of :
(1) Thigmotropism (2) Thermotaxis
(3) Thigmotaxis (4) Thigmonasty

Ans. (1)

62. Genetic engineering has been successfully used for producing :
(1) transgenic Cow-Rosie which produces high fat milk for making ghee
(2) animals like bulls for farm work as they have super power
(3) transgenic mice for testing safety of polio vac cine before use in humans
(4) transgenic models for studying new treatments for certain cardiac diseases

Ans. (3)

63. Which one of the following kinds of animals are *triploblastic* ?
(1) Ctenophores (2) Corals
(3) Flat worms (4) Sponges

Ans. (3)

64. Some hyperthermophilic organisms that grow in highly acidic (pH2) habitats belong to the two groups:
(1) Protists and mosses
(2) Liverworts and yeasts
(3) Eubacteria and archaea
(4) Cyanobacteria and diatoms

Ans. (3)

65. C_4 plants are more efficient in photosynthesis than C_3 plants due to :
(1) Presence of thin cuticle
(2) Lower rate of photorespiration
(3) Higher leaf area
(4) Presence of larger number of chloroplasts in the leaf cells

Ans. (2)

66. The chief water conducting elements of xylem in gymnosperms are :
(1) Transfusion tissue (2) Tracheids
(3) Vessels (4) Fibres

Ans. (2)

67. Cu ions released from copper-releasing Intra Uterine Devices (IUDs) :
(1) suppress sperm motility
(2) prevent ovulation
(3) make uterus unsuitable for implantation
(4) increase phagocytosis of sperms

Ans. (1)

68. Sertoli cells are found in :
(1) seminiferous tubules and provide nutrition to germ cells
(2) pancreas and secrete cholecystokinin
(3) ovaries and secrete progesterone
(4) adrenal cortex and secrete adrenaline

Ans. (1)

69. Which one of the following structures between two adjacent cells in an effective transport pathway ?
(1) Endoplasmic reticulum
(2) Plasmalemma
(3) Plasmodesmata
(4) Plastoquinones

Ans. (3)

70. The genetically-modified (GM) brinjal in India has been developed for :
(1) Enhancing mineral content
(2) Drought-resistance
(3) Insect-resistance
(4) Enhancing shelf life

Ans. (3)

71. Algae have cell wall made up of :
(1) Pectins cellulose and proteins
(2) Cellulose, cellulose and proteins
(3) Cellulose, galactans and mannans
(4) Hemicellulose, pectins and proteins

Ans. (3)

72. Which one of the following is one of the characteristics of a biological community ?
(1) Mortality
(2) Sex-ratio

(3) Stratification
(4) Natality

Ans. (3)

73. One example of animals having a single opening to the outside that serves both as mouth as well as anus is :
(1) *Ascidia* (2) *Fasciola*
(3) *Octopus* (4) *Asterias*

Ans. (2)

74. Satellite DNA is useful tool in :
(1) Forensic science
(2) Genetic engineering
(3) Organ transplantation
(4) Sex determination

Ans. (1)

75. One of the free-living, anaerobic nitrogen-fixer is :
(1) *Rhizobium* (2) *Azotobacter*
(3) *Beijenickia* (4) *Rhodospirillum*

Ans. (4)

76. A common biocontrol agent for the control of plant diseases in :
(1) *Glomus*
(2) *Trichoderma*
(3) Baculovirus
(4) *Bacillus thuringiensis*

Ans. (2)

77. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance ?
(1) Alleles do not show any blending and both the characters recover as such in F_2 generation.
(2) Factors occur in pairs
(3) The discrete unit controlling a particular char acter is called a factor
(4) Out of one pair of factors one is dominant, and the other recessive

Ans. (1)

78. Virus envelope is known as :
(1) Nucleoprotein (2) Core
(3) Capsid (4) Virion

Ans. (3)

79. If for some reason our goblet cells are non-functional, this will adversely affect :
(1) maturation of sperms
(2) smooth movement of food down the intestine
(3) production of somatostatin
(4) secretion of sebum from the sebaceous glands

Ans. (2)

80. Which one of the following statements about certain given animals is *correct* ?
(1) Insects are pseudocoelomates
(2) Flat worms (Platyhelminthes) are coelomates
(3) Round worms (Aschelminthes) are pseudocoe lomates
(4) Molluses are acoelomates

Ans. (3)

81. Breeding of crops with high levels of minerals, vitamins and proteins is called :
(1) Biomagnification (2) Micropropagation
(3) Somatic hybridisation
(4) Biofortification

Ans. (4)

82. Widal test is used for the diagnosis of :
(1) Tuberculosis (2) Typhoid
(3) Malaria (4) Pneumonia

Ans. (2)

83. The common nitrogen-fixer in paddy fields is :
(1) *Oscillatoria* (2) *Frankia*
(3) *Rhizobium* (4) *Azospirillum*

Ans. (4)

84. The energy-releasing metabolic process in which substrate is oxidised without an external electron acceptor is called :
(1) Aerobic respiration
(2) Photorespiration
(3) Glycolysis
(4) Fermentation

Ans. (4)

85. Which one of the following statements is *correct* with respect to AIDS ?
(1) AIDS patients are being fully cured cent per cent with proper care and nutrition
(2) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers
(3) The HIV can be transmitted through eating food together with an infected person
(4) Drug addicts are least susceptible to HIV in fection

Ans. (2)

86. Which one of the following statement in regard to the excretion by the human kidneys is *correct* ?
(1) Nearly 99 per cent of the glomerular filtrate is reabsobed by the renal tubules
(2) Ascending limb of Loop of Henle is imperme able to electrolytes
(3) Descending limb of Loop of Henle is imperme able to water
(4) Distal convoluted tubule is incapable of reab sorbing HCO_3^-

Ans. (1)

87. Some of the characteristics of Bt cotton are :
(1) High yield and production of toxic protein crys tals which kill dipteran pests
(2) High yield and resistance to bollworms
(3) Long fibre and resistance to aphids
(4) Medium yield, long fibre and resistance to beetle pests

Ans. (2)

88. *In vitro* fertilisation is a technique that involves transfer of which one of the following into the fallopian tube ?
(1) Embryo of 32 cell stage
(2) Zygote only
(3) Embryo only, upto 8 cell stage
(4) Either zygote or early embryo upto 8 cell stage

Ans. (4)

89. During mitosis ER and nucleolus begin to disappear at :
(1) Late metaphase
(2) Early prophase
(3) Late prophase
(4) Early metaphase

Ans. (2)

90. The plasma membrane consists mainly of :
(1) proteins embedded in a polymer of glucose molecuse
(2) proteins embedded in a carbohydrate bilayer
(3) phospholipids embedded in a protein bilayer
(4) proteins embedded in a phospholipid bilayer

Ans. (4)

91. Which one of the following is not a lateral meristem?
(1) Phellogen
(2) Intercalary meristem
(3) Intrafascicular cambium
(4) Interfascicular cambium

Ans. (2)

92. Membrane-bound organelles are *absent* in :
(1) *Chlamydomonas*
(2) *Plasmodium*
(3) *Saccharomyces*
(4) *Streptococcus*

Ans. (4)

93. Infectious proteins are present in :
(1) Viroids
(2) Satellite viruses
(3) Gemini viruses
(4) Prions

Ans. (4)

94. Vasa efferentia are the ductules leading from :
(1) Vas deferens to epididymis
(2) Epididymis to urethra
(3) Testicular lobules to rete testis
(4) Rete testis to vas deferens

Ans. (4)

95. If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect ?
(1) The blood will tend to flow back into the left atrium
(2) The flow of blood into the pulmonary artery will be reduced
(3) The flow of blood into the aorta will be slowed down
(4) The 'pacemaker' will stop working

Ans. (2)

96. Low Ca^{++} in the body fluid may be the cause of :
(1) Angina pectoris
(2) Gout
(3) Tetany
(4) Anaemia

Ans. (3)

97. Carrier ions like Na^+ facilitate the absorption of substances like :
(1) fatty acids and glycerol
(2) fructose and some amino acids
(3) amino acids and glucose
(4) glucose and fatty acids

Ans. (3)

98. Select the *correct* statement from the ones given below :

(1) Chewing tobacco lowers blood pressure and heart rate

(2) Cocaine is given to patients after surgery as it stimulates recovery

(3) Barbiturates when given to criminals make them tell the truth

(4) Morphine is often given to persons who have undergone surgery as a pain killer

Ans. (4)

99. Stirred-tank bioreactors have been designed for :

(1) Ensuring anaerobic conditions in the culture vessel

(2) Availability of oxygen throughout the process

(3) Addition of preservatives to the product

(4) Purification of the product

Ans. (2)

100. Which one of the following pairs is *incorrectly* matched ?

(1) Corpusluteum – Relaxin (secretion)

(2) Insulin – Diabetes mellitus (disease)

(3) Glucagon – Beta cells (source)

(4) somatostatin – Delta cells (source)

Ans. (3)

101. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:

(1) 12 V (2) 3V/2

(3) 3V/4 (4) 6V

Sol. [4]

$$\frac{mv^2}{R} = \frac{GM_e m}{R^2}$$

$$v = \sqrt{\frac{GM_e}{R}}$$

$$v \propto \frac{1}{\sqrt{R}}$$

$$\frac{V_A}{V_B} = \sqrt{\frac{R_B}{R_A}} = \sqrt{\frac{R}{4R}} = \frac{1}{2}$$

$$\frac{3V}{V_B} = \frac{1}{2}$$

$$\mathbf{V_B = 6V}$$

102. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to earth's field by placing a current carrying wire, the new time period of magnet will be

(1) 3s (2) 4s

(3) 1s (4) 2s

Sol.: [3]

$$T \propto \frac{1}{\sqrt{B}} \qquad \left(T = 2\pi\sqrt{\frac{I}{MB}}\right)$$

$$\frac{T_1}{T_2} = \sqrt{\frac{B_E - B_W}{B_E}}$$

$$\frac{2}{T_2} = \sqrt{\frac{24-18}{24}} = \sqrt{\frac{6}{24}} = \frac{1}{2}$$

$$\mathbf{T_2 = 4\ sec}$$

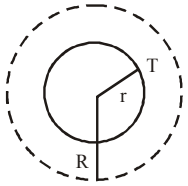
103. The total radiant energy per unit area, normal to the direction of indcidence , received at a distance R fropm the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K is given by

(1) $\sigma r^4 T^4 / r^4$ (2) $4\pi\sigma r^2 T^4 / R^2$

(3) $\sigma r^2 T^4 / R^2$ (4) $\sigma r^2 T^4 / 4\pi r^2$

(Where σ is Stefan's Constant)

Sol.: [3]



$$\frac{1}{A}\frac{dE}{dt} = \frac{\sigma 4\pi r^2 T^4}{4\pi R^2} = \frac{\sigma r^2 T^4}{R^2}$$

104. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/ s. The value of magnetic induction in Wb/m^2 at the centre of the ring is:

(1) $\frac{\mu_0 q}{2fR}$ (2) $\frac{\mu_0 qf}{2R}$

(3) $\frac{\mu_0 qf}{2\pi R}$ (4) $\frac{\mu_0 q}{2\pi fR}$

Sol.: [2]

$$B = \frac{\mu_0 i}{2R} = \frac{\mu_0}{2R} \times \frac{q}{T} = \boxed{\frac{\mu_0}{2R} qf}$$

105. Which of the following statement is false for the properties of electromagnetic waves?

(1) Both electric and magnetic field vectors are parallel to each other perpendicular to the direction of propagation of wave

(2) These waves do not require any material medium for propagation

(3) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time

(4) The energy in electromagnetic wave is divided equally between electric and magnetic vectors

Sol.: [1]

Conceptual

106. A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45°. for which of the following value of μ the ray can undergo total internal reflection?

(1) $\mu = 1.50$ (2) $\mu = 1.25$

(3) $\mu = 1.33$ (4) $\mu = 1.10$

Sol.: [1]

$$i > c \quad \sin i > \sin C$$

$$\sin 45^\circ > \frac{1}{\mu}$$

$$\mu > \frac{1}{\sin 45^\circ} = \sqrt{2}$$

107. Which one of the following statement is ***FALSE***?

(1) Minority cariers in a p-type semiconductor are electrons

(2) The resistance of intrinsic semiconductor decreases with increase of temperature

(3) Pure Si doped with trivalent impurities gives a p-type semiconductor

(4) Majority carriers in a n-type semiconductor are holes

Sol.: [4]

Coceptual

108. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be:

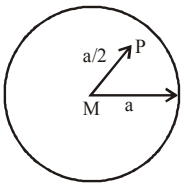
(1) $-\frac{GM}{a}$ (2) $-\frac{4GM}{a}$

(3) $-\frac{3GM}{a}$ (4) $-\frac{2GM}{a}$

Sol.: [3]

$$V_{atp} = -\frac{GM}{a} - \frac{GM}{a/2}$$

$$= -\frac{3GM}{a}$$



109. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

(1) $\sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$ (2) $\frac{4\pi\epsilon_0 Fd^2}{q^2}$

(3) $\frac{4\pi\epsilon_0 Fd^2}{e^2}$ (4) $\sqrt{\frac{4\pi\epsilon_0 Fe^2}{d^2}}$

Sol.: [1]

$$F = \frac{n^2e^2}{4\pi\epsilon_0 d^2}$$

$$\therefore \quad n = \sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$$

110. A lens having focal lengh f and aperture of diameter d forms an image of intensity I. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively

(1) f and $\frac{3I}{4}$ (2) $\frac{f}{2}$ and $\frac{I}{2}$

(3) f and $\frac{I}{4}$ (4) $\frac{3f}{4}$ and $\frac{I}{2}$

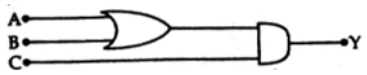
Sol.: [1]

$$f^{-1} = (\mu - 1)\left(\frac{2}{R}\right) \rightarrow \text{unchanged}$$

$I \propto$ Area of aperture

$$\frac{I'}{I} = \frac{A'}{A} = \frac{\pi\left(\frac{d^2}{4}\right) - \pi\left(\frac{d/2}{4}\right)^2}{\left(\pi\frac{d^2}{4}\right)} = \frac{3}{4}$$

111. To get an output Y = 1 from the circuit shown below, the input must be:



	A	B	C
(1)	1	0	1
(2)	1	0	0
(3)	0	1	0
(4)	0	0	1

Sol.: [1]

Boolean expression for output is

$$Y = (A + B)\cdot C$$

112. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

(1) $\Delta U = \Delta W$, in a adiabatic process

(2) $\Delta U = -\Delta W$, in a isothermal process

(3) $\Delta U = -\Delta W$, in a adiabatic process

(4) $\Delta U = \Delta W$, in a isothermal process

Sol.:[3]

In adiabatic $\Delta Q = 0$

$\therefore \quad \Delta U + \Delta W = 0 \qquad \therefore \quad \Delta U = -\Delta W$

113. The device that can act as a complete electronic circuit is:

(1) Junction transistor (2) Zener diode

(3) Junction diode (4) Integrated circuit

Sol.:[4]

Conceptual

114. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and $2v$ at any instant, then the speed of centre of mass of the system will be

(1) $1.5v$ (2) v

(3) $2v$ (4) zero

Sol.:[4]

$\vec{F}_{ext} = \vec{0}$ and $\vec{U}_{CM} = \vec{0}$

$\therefore \quad \vec{p}_i = \vec{p}_f = \vec{0}$ at any time

$\therefore \quad \vec{V}_i = \vec{V}_f = \vec{0}$

115. A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2 is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2 in terms of C_1, is then:

(1) $2\frac{n_2}{n_1}C_1$ (2) $\frac{16C_1}{n_1n_2}$

(3) $\frac{2C_1}{n_1n_2}$ (4) $16\frac{n_2}{n_1}C_1$

Sol.:[2]

$$\frac{1}{2}n_2C_2(V)^2 = \frac{1}{2}\frac{C_1}{n_1}(4V)^2$$

$$\therefore \quad C_2 = \frac{16C_1}{n_1n_2}$$

116. A source S_1 is producing, 10^{15} photons per second of wavelength 5000Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100Å. Then (power of S_2)/ (power of S_1) is equal to

(1) 1.04 (2) 0.98

(3) 1.00 (4) 1.02

Sol.:[3]

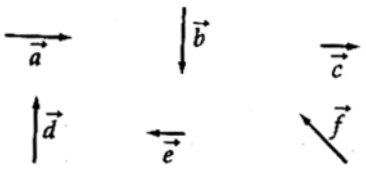
$$\text{Power} = \frac{\text{Energy emitted}}{\text{time}}$$

$$P = \frac{nh\nu}{t} = \frac{nhc}{\lambda t} \quad \therefore P \propto \frac{n}{\lambda}$$

$$\therefore \quad \frac{P_2}{P_1} = \frac{n_2}{n_1}\times\frac{\lambda_1}{\lambda_2} = \frac{1.02\times10^{15}}{10^{15}}\times\frac{5000}{5100}$$

$$= \frac{2}{100}\times50 = 1$$

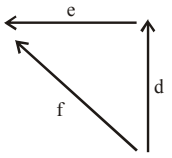
117. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true



(1) $\vec{d}+\vec{e}=\vec{f}$ (2) $\vec{b}+\vec{e}=\vec{f}$

(3) $\vec{b}+\vec{c}=\vec{f}$ (4) $\vec{d}+\vec{c}=\vec{f}$

Sol.:[1]



$\vec{d}+\vec{e}=\vec{f}$

118. A transverse wave is represented by $y = A\sin(wt-kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

(1) $2\pi A$ (2) A

(3) $\pi A/2$ (4) πA

Sol.:[1]

$$V_{\text{of Wave}} = \frac{w}{K}$$

$$V_{\text{of Particle(max)}} = Aw$$

$$\therefore \quad \frac{w}{K} = Aw$$

$$\therefore \quad \frac{\lambda}{2\pi} = A \Rightarrow \lambda = 2\pi A$$

119. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts and amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t?

(1) 2Q (2) Q/2

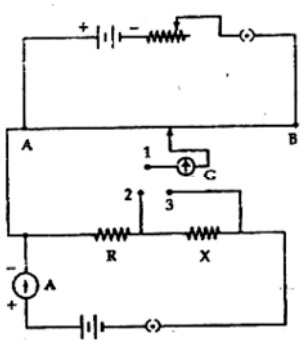
(3) Q/4 (4) Q/16

Sol.:[4]

$$\frac{Q}{t} = \frac{K(\pi r^2)(T_2 - T_1)}{l}$$

$$\left(\frac{Q}{t}\right)_{\text{new}} = K\frac{\pi\left(\frac{r}{2}\right)^2}{4l}(T_2 - T_1) = \frac{1}{16}\left(\frac{Q}{t}\right)$$

120. A potentiometer or circuit is set up as shown. The potential gradient, across the potentiometer wire, is k volt/ cm and the ammeter, present in the circuit, reads 10A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths l_1 cm and l_2 cm respectively. The magnitudes, of the resistors R and X, in ohms, are then, equal, respectively, to



(1) k(l_2–l_1) and kl_1 (2) kl_1 and kl_2

(3) $k(l_2–l_1)$ and kl_2 (4) kl_1 and k(l_2–l_1)

Sol.:[4]

$$V_{12} = kl_1 = V_R$$

$$V_{13} = kl_2 = V_R + V_X$$

$$\therefore \quad \frac{l_1}{l_2} = \frac{V_R}{V_R + V_X} = \frac{R}{R + X}$$

$$\frac{l_2}{l_1} = \frac{R + X}{R} = 1 + \frac{X}{R}$$

$$\therefore \quad \frac{X}{R} = \frac{l_2}{l_1} - 1 = \frac{l_2 - l_1}{l_1}$$

$$\therefore \quad V_X = k(l_2 - l_1)$$

$$V_R = kl_1$$

121. A ball is dropped from a high rise platform at t = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 s. What is the value of v? (Take g = 10 m/s^2)

(1) 40 m/s (2) 60 m/s

(3) 75 m/s (4) 55 m/s

Sol.:[3]

$$\frac{1}{2} \times g \times 18^2 = v[18 - 6] + \frac{1}{2}g[18 - 6]^2$$

$$5 \times 324 = v \times 12 + 5 \times 12^2$$

$$5 \times 324 = 12V + 5 \times 144$$

$$12v = 5[324 - 144] = 5[180]$$

$$v = \frac{5 \times 180}{12} = \boxed{75\,m/s}$$

122. The energy of a hydrogen atom in the ground state is –13.6 eV. The energy of a He^+ ion in the first excited state will be:

(1) –55.4 eV (2) –6.8 eV

(3) –13.6 eV (4) –27.2 eV

Sol.:[3]

$$E = -13.6\frac{Z^2}{n^2} = -13.6 \times \frac{Z^2}{2^2} = -13.6\,eV$$

123. Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?

(1) ionic bonding

(2) covalent bonding

(3) metallic bonding

(4) van der Waal's bonding

Sol.: [1]

Conceptual

124. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine

(1) 100 W (2) 800 W

(3) 400 W (4) 200 W

Sol.: [2]

$$P = F\nu$$

$$= \left(\frac{dp}{dt}\right)\nu = \left[\frac{d(mv)}{dt}\right]\nu$$

$$= \nu^2\left(\frac{dm}{dt}\right) = \nu\frac{dm}{dl}\times\frac{dl}{dv} = \nu^2.\frac{dm}{dl}.\nu$$

$$= \left(\frac{dm}{dl}\right)\nu^3 = 100\times 2^3 = 800\,W$$

125. A common emitter amplifier has a voltage gain of 50 , an input impedance of 100Ω and an output impedance of 200Ω. The power gain of the amplifier is

(1) 1250 (2) 50

(3) 500 (4) 1000

Sol.: [1]

$$V_g = \alpha\frac{R_L}{R_i} \Rightarrow 50 = \alpha\frac{200}{100} \Rightarrow \alpha = 25$$

$$P_g = \alpha\frac{R_L}{R_i} = (25)^2\frac{200}{100} = 1250$$

126. A conducting circular loop is placed in a uniform magnetic field B = .025 T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced emf when the radius is 2 cm, is:

(1) $\frac{\pi}{2}\mu V$ (2) $2\mu V$

(3) $2\pi\mu V$ (4) $\pi\mu V$

Sol.: [4]

$$\phi = \vec{B}\cdot\vec{S} = B\pi r^2$$

$$|e| = \frac{d\phi}{dt} = B2\pi r\frac{dr}{dt} = 0.025\times 2\pi\times 2\times 10^{-2}$$

$$|e| = \pi\mu V$$

127. The potential difference that must be applied to stop the fastest photo electrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be:

(1) –2.4 V (2) 12 V

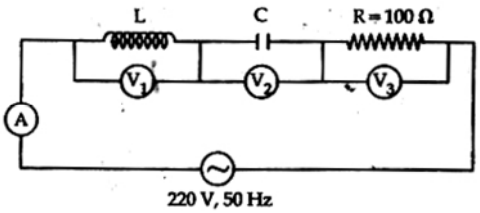
(3) 2.4 V (4) –1.2V

Sol.: [4]

$$e|V_0| = \frac{hc}{\lambda} - \phi \Rightarrow eV_0 = \frac{12400eVA^o}{2000A^o} - 5.01eV$$

$\Rightarrow |V_0| = 1.2$ volt , but stopping potential is always –ve. So V_0= –1.2 Volt

128. In the given circuit the reading of voltmeter V_1 and V_2 are 300 volts each. The reading of the voltmeter V_3 and ammeter A are respectively:



(1) 220 V, 2.0 A (2) 100 V, 2.0 A

(3) 150 V, 2.2 A (4) 220 V, 2.2 A

Sol.: [4]

As $V_1 = V_2 \Rightarrow IX_L = IX_C$, so, $X_L = X_C$

circuit is in resonance. So $V = V_3 = 220\,V$ and

$$I = \frac{V}{R} = \frac{220}{100} = 2.2A$$

129. A circular disk of moment of inertia I_t, is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_i. Another disk of moment of inertia I_b is dropped coaxially onto the rotating disk. Initially the second disk has zero angular sppeed. Eventually both the disks rotate with a constant angular speed ω_f. The energy lost by the initially rotating disc to friction is:

(1) $\frac{I_b - I_t}{(I_t + I_b)}\omega_i^2$ (2) $\frac{1}{2}\frac{I_b I_t}{(I_t + I_b)}\omega_i^2$

(3) $\frac{1}{2}\frac{I_b^2}{(I_t + I_b)}\omega_i^2$ (4) $\frac{1}{2}\frac{I_t^2}{(I_t + I_b)}\omega_i^2$

Sol.:[2]

Using conservation of angular momentum about central axis

$$I_t\omega_i = (I_t + I_b)\omega_f$$

$$\omega_f = \frac{I_t + \omega_i}{I_t + I_b} \qquad ...(i)$$

now, $KE_{lost} = \frac{1}{2}I_t\omega_i^2 - \frac{1}{2}(I_t + I_b)\omega_f^2$

putting ω_f from (i)

$$KE_{lost} = \frac{1}{2}\frac{I_bI_t}{I_b + I_t}(\omega_i)^2$$

130. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another massM is also suspended, the period of oscillation will now be:

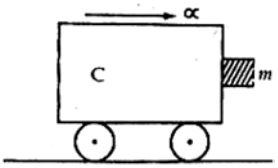
(1) 2T (2) $\sqrt{2}T$

(3) T (4) $T/\sqrt{2}$

Sol.:[2]

$$T = 2\pi\sqrt{\frac{m}{k}} \text{ if } m' = 2m,\ T' = \sqrt{2}T$$

131. A block of mass m is in contact with the cart C as shown in the figure.



The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies:

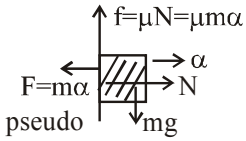
(1) $\alpha \geq \frac{g}{\mu}$ (2) $\alpha < \frac{g}{\mu}$

(3) $\alpha > \frac{mg}{\mu}$ (4) $\alpha > \frac{g}{\mu m}$

Sol.:[1]

$f = \mu N = \mu m\alpha$

for not falling



$\mu m\alpha \geq mg$

$$\alpha \geq \frac{g}{\mu}$$

132. A galvanometer has a coil of resistance 100 ohm and gives a full scale deflection for 30 mA current. If it is to work as a voltmeter of 30 volt range, the resistance required to be added will be:

(1) 500Ω (2) 500Ω

(3) 900Ω (4) 1800Ω

Sol.:[4]

$R_g = 100\Omega,\ i_g = 30\,m,\ V = 30\ V$

$$R_{se} = \left(\frac{V}{i_gR_g} - 1\right)R_g$$

$$= \left(\frac{30}{30\times10^{-3}\times100} - 1\right)\times100 = 900\Omega$$

133. A beam of cathode rays is subjected to crossed Electric (E) and Magnetic fields (B). The fields are adjusted such that the beam is not deflected. the specific charge of the cathode rays is given by:

(1) $\frac{2VE^2}{B^2}$ (2) $\frac{E^2}{2VB^2}$

(3) $\frac{B^2}{2VE^2}$ (4) $\frac{2VB^2}{E^2}$

(Where V is the potential difference between cathode and anode)

Sol.:[2]

$$Bqv = qE \qquad ...(i)$$

$$v = \frac{E}{B}$$

$$\frac{1}{2}mv^2 = qV$$

$$\frac{1}{2}m\frac{E^2}{B^2} = qV$$

$$\frac{q}{m} = \frac{E^2}{2B^2V}$$

134. Consider the following statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

(1) (A) is wrong and (B) is correct

(2) Both (A) and (B) are correct

(3) Both (A) and (B) are wrong

(4) (A) is correct and (B) is wrong

Sol.: [2]

Conceptual

135. The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minutes at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is:

(1) $5log_{10}2$ (2) $5log_e2$

(3) $log_e2/5$ (4) $\frac{5}{log_e2}$

Sol.: [2]

$$N = N_0e^{-\lambda t}$$

$$\frac{N_0}{e} = N_0e^{-\lambda\times5}$$

$$\lambda = \frac{1}{5}$$

$$T_{1/2} = \frac{\log_e 2}{\lambda} = 5\log_e 2$$

136. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if:

(1) $r \le \frac{\mu g}{\omega^2}$ (2) $r \ge \frac{\mu g}{\omega^2}$

(3) $r = \mu g\omega^2$ (4) $r < \frac{\omega^2}{\mu g}$

Sol.: [1]

$$f \ge m\omega^2 r$$

$$\mu mg \ge m\omega^2 r$$

$$\mu \ge \frac{\omega^2 r}{g}$$

$$r \le \frac{\mu g}{\omega^2}$$

137. A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is:

(1) 2.5 ampere (2) 50 ampere

(3) 3.6 ampere (4) 2.8 ampere

Sol.: [2]

$$n = 0.8 = \frac{440\times2}{220\times I}$$

$$I = 5A$$

138. A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to:

(1) $(\text{distance})^{-2}$ (2) $(\text{velocity})^{2/3}$

(3) $(\text{velocity})^{3/2}$ (4) $(\text{distance})^2$

Sol.: [3]

$$x = (t+5)^{-1}$$

$$v = -1(t+5)^{-2}$$

$$a = 2(t+5)^{-3}$$

139. The mass of a ^7_3Li nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of ^7_3Li nucleus is nearly:

(1) 3.9 MeV (2) 26 MeV

(3) 46 MeV (4) 5.6 MeV

Sol.: [4]

$$\frac{\text{B.E.}}{\text{nucleon}} = \frac{0.042\times931}{7} = 5.6\,\text{MeV}$$

140. The displacement of a particle alone the x axis is given by $x = a\sin^2\omega t$. The motion of the particle corresponds to:

(1) non simple harmonic motion

(2) simple harmonic motion of frequency $\omega/2\pi$

(3) simple harmonic motion of frequency ω/π

(4) simple harmonic motion of frequency $3\omega/2\pi$

Sol.: [3]

$$x = \frac{a(1-\cos2\omega t)}{2}$$

141. A The dimension of $\frac{1}{2}\in_0 E^2$, where $\in_0$ is permittivity of free space and E is electrif field, is

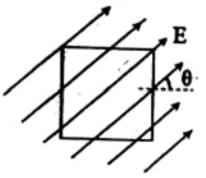
(1) ML^2T^{-1} (2) MLT^{-1}

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

Sol.:[4]

$$\frac{1}{2}\in_0 E^2 = \frac{\text{Energy}}{\text{volume}} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$

142. A square surface of side L meter in the plane of the paper is placed in a uniform electric field E (volt/ m) acting along the same plane at an angle θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface, in units of volt -m, is



(1) $EL^2\sin\theta$ (2) zero

(3) EL^2 (4) $EL^2\cos\theta$

Sol.:[2]

$$\phi = \vec{E}\cdot\vec{A}$$

$$= EA\cos 90^\circ = 0$$

143. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge Ze. Then the nucleus will be proportional to:

(1) $\frac{1}{m}$ (2) $\frac{1}{v^2}$

(3) $\frac{1}{Ze}$ (4) v^2

Sol.:[1]

144. Electromagnets are made of soft iron because soft iron has

(1) low retentivity and low coercive force

(2) high retentivity and low coercive force

(3) low retentivity and high coercive force

(4) hig retentivity and high coercive force

Sol.:[1]

145. A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed 2 m/s. When the stone reaches the floor, the distance of the man above the floor will be:

(1) 10 m (2) 20 m

(3) 99 m (4) 10.1 m

Sol.:[4]

$$\vec{P}_i = \vec{P}_t$$

$$0 = 50V_1 - 0.5\times 2$$

$$V_1 = \frac{1}{50}\text{m/s}$$

Time taken to reach floor = 10/2 = 5 sec.

$$\text{Distance moved by man in 5 sec} = \frac{1}{50}\times 5 = \frac{1}{10\text{m}}$$

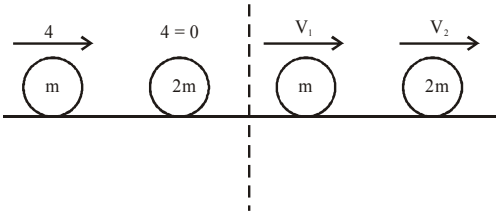
$$\text{Distance from floor} = 10 + \frac{1}{10} = 10.1\text{m}$$

146. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be:

(1) 1, 0.5 (2) 0, 2

(3) 0, 1 (4) 1, 1

Sol.:[3]



$$mu + 2m\times 0 = mv_1 + 2mv_2$$

$$v_1 + 2v_2 = 2 \quad \text{...(i)}$$

$$e = \frac{v_2 - v_1}{u_1 - u_2}$$

$$v_2 - v_1 = 1 \quad \text{..(ii)}$$

$$v_2 = 1\text{m/s}$$

$$v_1 = 0$$

147. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated (E.C.E. of chlorine is 0.367×10^{-6} Kg/C)

(1) 17.61×10^{-3} kg (2) 3.67×10^{-3} kg

(3) 1.76×10^{-3} kg (4) 9.67×10^{-3} kg

Sol.: [1]

$$n = ZIt \Rightarrow Z\frac{P}{V}t$$

$$= 0.367 \times 10^{-6} \times \frac{100 \times 10^3}{125} \times 60$$

$$= 17.61 \times 10^{-3}\ \text{kg}$$

148. A particle has initial velocity $\left(3\hat{i} + 4\hat{j}\right)$ and has acceleration $\left(0.4\hat{i} + 0.3\hat{j}\right)$. Its speed after 10 s is:

(1) 8.5 units (2) 10 units

(3) 7 units (4) $7\sqrt{2}$ units

Sol.: [4]

$$|\vec{v}| = |\vec{v}_x + \vec{v}_y|$$

$$= \left|(u_x + a_x t)\hat{i} + (u_y + a_y t)\hat{j}\right|$$

$$\left|7\hat{i} + 7\hat{j}\right| = 7\sqrt{2}$$

149. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loops is :

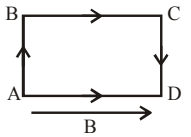
(1) $-3\vec{F}$ (2) $\vec{F}$

(3) $3\vec{F}$ (4) $-\vec{F}$

Sol.: [4]

$$F_{BC} = F_{AD} = 0$$

$$\vec{F}_{AB} = -\vec{F}_{CD}$$



150. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreaes to 2 beats per sec when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was:

(1) 516 Hz (2) 508 Hz

(3) 510 Hz (4) 514 Hz

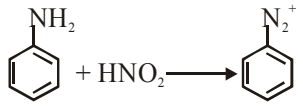
Sol.: [1]

$$f_T - f_P = 4$$

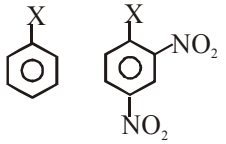
$$f_P = 508$$

151. Which of the following statements about primary amines is 'False'?
(1) Aryl amines react with nitrous acid to produce phenols
(2) Alkyl amines are stronger bases than ammonia
(3) Alkyl amines are stronger bases than aryl amines
(4) Alkyl amines react with nitrous acid to produce alcohols

Ans. **(1)**

Sol. 

152. The correct order of increasing reactivity of C–X bond towards nucleophile in the following compound is



$(CH_3)_3C–X$ $(CH_3)_2CH–X$

(I) (II) (III) (IV)
(1) IV < III < I < II
(2) III < II < I < IV
(3) I < II < IV < III
(4) II < III < I < IV

Ans. **(3)**

Sol. I < II < IV < III

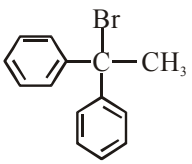
153. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be
(1) more than ΔH
(2) equal to zero
(3) less than ΔH
(4) equal to ΔH

Ans. **(4)**

Sol. Minimum value of $E_a = \Delta H$

154. Which one is most reactive towards S_N^1 reaction?
(1) $C_6H_6C(CH_3)(C_6H_5)Br$
(2) $C_6H_5CH_2Br$
(3) $C_6H_5CH(C_6H_5)Br$
(4) $C_6H_5CH(CH_3)Br$

Ans. **(1)**

Sol.  is most reactive

155. Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$, are respectively
(1) +5 + 4, +3
(2) +3 , + 4, + 5
(3) +3, +5, +4
(4) + 5, +3, + 4

Ans. **(2)**

Sol. +3, +4, +5

156. If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its $K_{(SP)}$ is
(1) $5.00 \times 10^{-6}\ M^3$
(2) $5.00 \times 10^{-7}\ M^3$
(3) $4.00 \times 10^{-6}\ M^3$
(4) $4.00 \times 10^{-7}\ M^3$

Ans. **(2)**

Sol. $[H^+] = 10^{-12}$

$[OH^-] = 10^{-2}$

$$Ba(OH)_2 \rightleftharpoons Ba^{2+} + \underset{10^{-2}}{2OH^-}$$

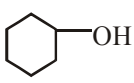
$$K_{sp} = \left[Ba^{2+}\right]\left[OH^{-1}\right]^2$$

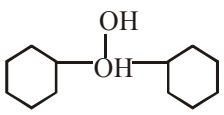
$$= \left(\frac{10^{-2}}{2}\right)(10^{-2})^2$$

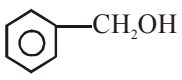
$$= 0.5 + 10^{-2} \times 10^{-4}$$

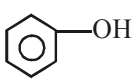
$$= 0.5 \times 10^{-6} = 5 \times 10^{-7}$$

157. Which of the following compounds has the most acidic nature?

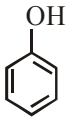
(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

Sol.  phenol is more acidic than alcohol.

158. Standard entropies of X_2, Y_2 and XY_3 are 60, 40 and 50 J K^{-1} mol^{-1} respectively. For the reaction

$\frac{1}{2}X_2 + \frac{3}{2}Y_3 \rightleftharpoons XY_3, \Delta H = -30kJ$ to be at equilibrium, the temperature should be

(1) 1250 K
(2) 500 K
(3) 750 K
(4) 1000 K

Ans. **(3)**

Sol.

$$\Delta S = S_{product} - S_{reactant} = 50 - \left(\frac{1}{2}\times 60 + \frac{3}{2}\times 40\right) \quad \Bigg| \quad -40J = \Delta S \quad T = \frac{30\times 10^3}{-40} = \frac{30,000}{40}$$

159. Which of the following structures represents Neoprene polymer?

(1) $-\left(CH_2-\underset{Cl}{\underset{|}{C}}H\right)_n-$

(2) $-\left(\underset{C_6H_5}{\underset{|}{C}}H-CH_2\right)_n-$

(3) $-\left(CH_2-\underset{Cl}{\underset{|}{C}}=CH-CH_2\right)_n-$

(4) $-\left(CH_2-\underset{CN}{\underset{|}{C}}H\right)_n-$

Ans. **(3)**

Sol. $-\left(CH_2-\underset{Cl}{\underset{|}{C}}l=CH-CH_2\right)_n-$ is neoprane.

160. In which of the following pairs of molecules/ ions, the central atoms have sp^2 hybridization?

(1) NH_2^- and H_2O
(2) BF_3 and NH_2
(3) NO_2^- and NH_3
(4) BF_3 and NO_2^-

Ans. **(4)**

Sol. BF_3 and NO_2^- are sp^2 hybridised

161. Which one of the following does *not* exhibit the phenomenon of mutarotation?

(1) (+) Maltose
(2) (–) Fructose
(3) (+) Sucrose
(4) (+) Lactose

Ans. **(3)**

Sol. (+) Sucrose does not exhibit mutarotation.

162. Which one of the following ions has electronic configuration [Ar]$3d^6$?

(1) Fe^{3+}
(2) Co^{3+}
(3) Ni^{3+}
(4) Mn^{3+}

Ans. **(2)**

Sol. Co^{3+} ; (Ar) $3d^6$

163. Which of the following complex ion is not expected to absorb visible light?

(1) $\left[Fe(H_2)_6\right]^{2+}$
(2) $\left[Ni(H_2O)_6\right]^{2+}$
(3) $\left[Ni(CN)_4\right]^{2-}$
(4) $\left[Cr(NH_3)_6\right]^{3+}$

Ans. **(3)**

Sol. $[Ni(CN)_4]^2$ does not contain unpaired e^-

164. Property of the alkaline earth metals that increases with their atomic number

(1) Ionization energy
(2) Electronegativity
(3) Solubility of their hydroxides in water
(4) Solubility of their sulphates in water

Ans. **(3)**

Sol. Solubility of hydroxides of alkaline earthmetals increases down the group.

165. During the kinetic study of the reaction, 2A + B $\rightarrow$ C + D, following results were obtained:

Run	[A] mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D/mol L^{-1} min^{-1}
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data which one of the following is correct?

(1) $\text{rate} = k[A]^2[B]^2$
(2) $\text{rate} = k[A][B]^2$
(3) $\text{rate} = k[A]^2[B]$

(4) $\text{rate} = k[A][B]$

Ans. **(2)**

Sol. Rate law K [A][B]^2

166. 25.3 g of sodium carbonate, Na_2CO_2 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of Na_2CO_3 = 106 g mol^{-1})

(1) 1.90 M and 1.910 M

(2) 0.477 M and 0.477 M

(3) 0.955 M and 1.910 M

(4) 1.910 M and 0.955 M

Ans. **(4)**

Molarity of

$$Na_2CO_3 = \frac{25.3/100}{250} \times 100 = \frac{25.3 \times 1000}{106 \times 250} = 0.953$$

$$\underset{0.955}{Na_2CO_3} \rightarrow \underset{0}{2Na^+} + \underset{0}{CO_3^{2-}}$$

$0.955 \;.\; 0.955 \qquad 2 \times 0.955 \quad 0.955$

$\qquad\qquad\quad = 1.910 \quad 0.955$

167. In which one of the following species the central atom has type of hybridisation which is not the same as that present in the other three?

(1) $SbCl_5^{2-}$

(2) PCl_5

(3) SF_4

(4) I_3

Ans. **(1)**

$SbCl_5^{2-}$ is $sp3d^2$ hybridised and rest three are sp^3d hybridised

168. Which one of the following species does not exist under normal conditions?

(1) B_2

(2) Li_2

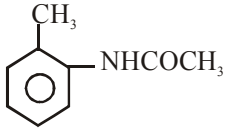
(3) Be_2^+

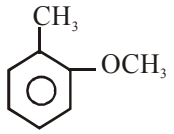
(4) Be_2

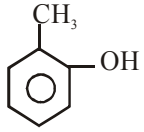
Ans. **(4)**

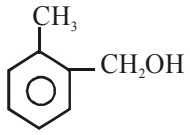
Bond order of Be_2 = 0; so under normal condition it does not exist

169. Which one is most reactive towards electrophilic reagent?

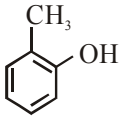
(1) 

(2) 

(3) 

(4) 

Ans. **(3)**

 most activating.

170. For the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ the value of rate of disappearance of N_2O_5 is given as 6.25×10^{-3} mol L^{-1}s^{-1}. The rate of formation of NO_2 and O_2 is given respectively as

(1) 6.25×10^{-3} mol L^{-1}s^{-1} and 3.125×10^{-3} mol L^{-1}s^{-1}

(2) 1.25×10^{-2} mol L^{-1}s^{-1} and 6.25×10^{-3} mol L^{-1}s^{-1}

(3) 6.25×10^{-3} mol L^{-1}s^{-1} and 6.25×10^{-3} mol L^{-1}s^{-1}

(4) 1.25×10^{-2} mol L^{-1}s^{-1} and 3.125×10^{-3} mol L^{-1}s^{-1}

Ans. **(4)**

$$\frac{-d[N_2O_5]}{dt} = \frac{1}{2}\frac{d[NO_2]}{dt} = \frac{2d(\sigma_2)}{dt}$$

$$\frac{d(N_2O_5)}{dt} = 6.25 \times 10^{-3}$$

$$\frac{d(NO_2)}{dt} = 2 \times 6.25 \times 10^{-3} = 1.25 \times 10^{-2}$$

$$\frac{d[O_2]}{dt} = \frac{1}{2} \times 6.25 \times 10^{-3} = 3.125 \times 10^{-3}$$

171. The correct order of the decreasing ionic radii among the following isoelectronic species is

(1) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

(2) $K^+ > Ca^{2+} > Cl^- > S^{2-}$

(3) $Ca^{2+} > K^+ > S^{2-} > Cl^-$

(4) $Cl^- > S^{2-} > Ca^{2+} > K^+$

Ans. (1)

$S^{2-} > Cl^- > K^+ > Ca^{2+}$

172. AB crystallizes in a body centred cubic lattice with edge length 'a' equal to 387 pm. The distance between two appositively charged ions in the lattice is

(1) 200 pm
(2) 300 pm
(3) 335 pm
(4) 250 pm

Ans. (3)

$$r^+ + r^- = \frac{\sqrt{3}a}{2} = \frac{1.732 \times 387}{2} = 335 \text{ pm}$$

173. Which of the following ions will exhibit colour in aqueous solutions?

(1) Lu^{3+} (z = 71)
(2) Sc^{3+} (z = 21)
(3) La^{3+} (z = 57)
(4) Ti^{3+} (z = 22)

Ans. (4)

174. That is $[H^+]$ in mol/L of a solution that is 0.20 M in CH_3COONa and 0.10 M in CH_3COOH? a for $CH_3COOH = 1.8 \times 10^{-5}$

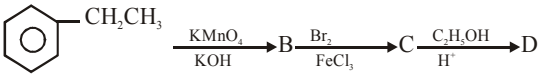
(1) 1.8×10^{-5}
(2) 9.0×10^{-6}
(3) 3.5×10^{-4}
(4) 1.1×10^{-5}

Ans. (2)

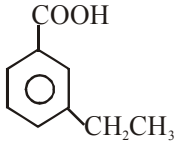
$$pH = pKa + \log\frac{(salt)}{[Acid]} = 4.74 + \log\frac{0.2}{0.1} = 4.74 + 0.3 = 5.04$$

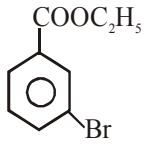
$[H^+] = 9 \times 10^{-6}$

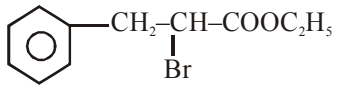
175. In a set of reactions, ethyl benzene yielded a product D

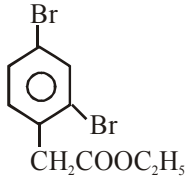


'D' would be

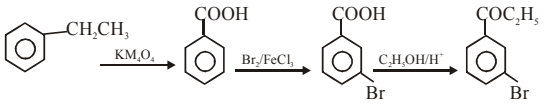
(1) 

(2) 

(3) 

(4) 

Ans. (2)



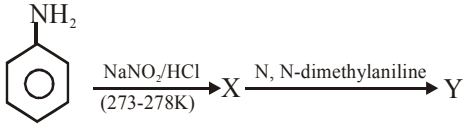
176. Which one of the following compounds is a peroxide?

(1) MnO_2
(2) NO_2
(3) KO_2
(4) BaO_2

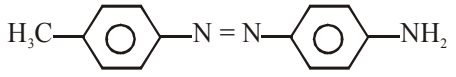
Ans. (4)

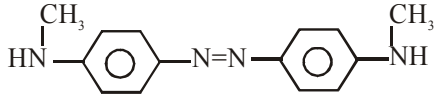
BaO_2

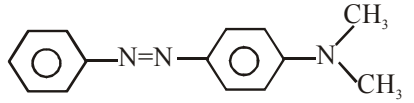
177. Amiline in a set of the following reactions yielded a coloured product 'Y'

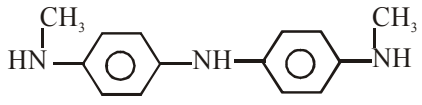


The structure 'Y' would be

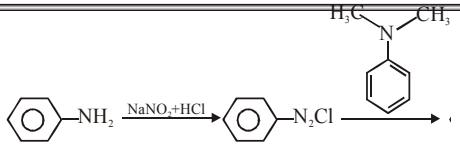
(1) 

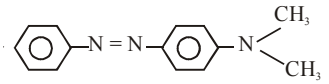
(2) 

(3) 

(4) 

Ans. (3)



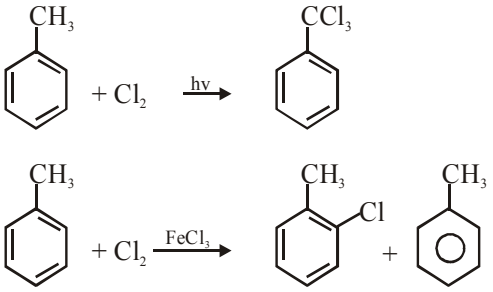


178. Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is
(1) $CH_3COOCOCH_3$
(2) CH_3COCl
(3) CH_3COOCH_3
(4) CH_3CONH_2

Ans. **(2)**

179. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light given 'Y'. Thus, 'X' 'X' and 'Y' are
(1) Y = o-and p-chlorotoluene, Y = Trichloromethyl benzene
(2) X = Benzyl chloride, Y = m - chlorotoluene
(3) X = Benzal chloride, Y = 0-chlorotoluene
(4) X = m - chlorotoluene, Y= p - chlorotoluene

Ans. **(1)**



180. Which one of the following is employed as Tranquilizer drug?
(1) Naproxen
(2) Mifepristone
(3) Promethazine
(4) Valium

Ans. **(4)**
Valium

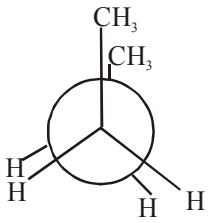
181. Which one of the following molecular hydrides acts as a Lewis acid?
(1) B_2H_6
(2) CH_4
(3) NH_3
(4) H_2O

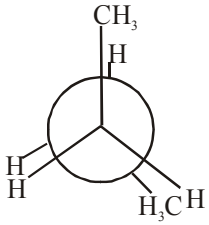
Ans. **(1)**
B_2H_6 is Lewis acid

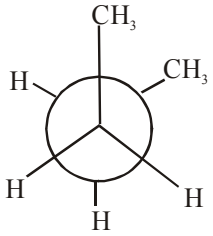
182. The number of atoms in 0.1 mol of a triatomic gas is : ($N_A = 6.02 \times 10^{23}$ mol^{-1})
(1) 3.600×10^{23}
(2) 1.800×10^{22}
(3) 6.026×10^{22}
(4) 1.806×10^{23}

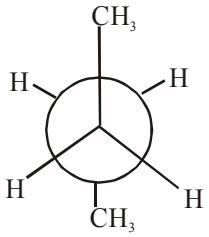
Ans. **(4)**
No. of atoms = $0.1 \times 6.02 \times 10^{23} \times 3$
$= 1.806 \times 10^{23}$

183. In the following the most stable conformation of a-butane is

(1) 

(2) 

(3) 

(4) 

Ans. **(4)**
Anti conformation is most stable

184. Acetamide is treated with the following reagents separately. Which one of these would yield methyl amine?
(1) Hot conc. H_2SO_4
(2) PCl_5

(3) $NaOH–Br_2$
(4) Sodalime

Ans. **(3)**

Hoffmann Bromamide reaction.

185. The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^+$ is due to
(1) Coordination isomerism
(2) Ionization isomerism
(3) Linkage isomerism
(4) Geometrical isomerism

Ans. **(4)**

Due to ionisation isomerism.

186. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?
(1) $BaSO_4$
(2) $SrSO_4$
(3) $CaSO_4$
(4) $BeSO_4$

Ans. **(4)**

$BeSO_4$

187. For the reduction of silver ions with copper metal the standard cell potential was found be +0.46 V at 25°C. The value of standard Gibbs energy, $\Delta G°$ will ($F = 96500\ C\ mol^{-1}$)
(1) –44.5 kJ
(2) –98.0 kJ
(3) –89.0 kJ
(4) –89.0 J

Ans. **(3)**

$= -2 \times 96500 \times 0.46 = -88.78 = -89$ kJ

188. A solution of sucrose (molar mass =342 g mol^{-1} has been prepared by dissolving 68.5 g of sucrose in 1000 g of water. The freezing point of the solution obtained will be (K_f for water = 1.86 K kg mol^{-1})
(1) +0.372°C
(2) –0.570°C
(3) –0.372°C
(4) +0.520°C

Ans. **(3)**

$$\Delta T_f = kf.m = 1.86 \times \frac{68.5}{342 \times 100} \times 1000$$

$$= 0.372$$

$$T_f = 0 - 0.372 = -0.372°C$$

189. Liquid hydrocarbons can be converted to a mixture of gaseous hydrocarbons by
(1) Distillation under reduced pressure
(2) Hydrolysis
(3) Oxidation
(4) Cracking

Ans. **(4)**

190. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to
(1) Increase in both i.e. number of ions and ionic ability of ions
(2) Increase in number of ions
(3) Increase in ionic mobility of ions
(4) 100% ionisation of electrolyte at normal dilution

Ans. **(2)**

Increase is due to increase in no. of ions.

191. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution of increase?
(1) Addition of 1.00 molal KI
(2) Addition of water
(3) Addition of NaCl
(4) Addition of Na_2SO_4

Ans. **(2)**

Addition of water came the increase in vapour presence

192. The correct order of increasing bond angles in the following species is
(1) $Cl_2O < ClO_2^- < ClO_2$
(2) $ClO_2^- < Cl_2O < ClO_2$
(3) $Cl_2O < ClO_2 < ClO_2^-$
(4) $ClO_2 < Cl_2O < ClO_2^-$

Ans. **(2)**

193. In which of the following equilibrium K_c and K_p are not equal
(1) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$
(2) $2C_{(s)} + O_2(g) \rightleftharpoons 2CO_{2(g)}$
(3) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
(4) $SO_{2(g)} + NO_{2(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$

Ans. **(2)**

$\Delta n_g \neq 0$ for $2C(s) + O_2(g) \rightleftharpoons 2CO_2(g)$

194. The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence
(1) $BBr_3 > BF_3 > BCl_3$
(2) $BF_3 > BCl_3 > BBr_3$
(3) $BCl_3 > BF_3 > BBr_3$

(4) $BBr_3 > BCl_3 > BF_3$

Ans. (4)

$BBr_3 > BCl_3 > BF_3$: due to $p\pi - p\pi$ back bonding.

195. Which of the following reactions will not result in the formation of carbon-carbon bonds?

(1) Wurtz reaction
(2) Friedel-Crafts acylation
(3) Reimer-Tieman reaction
(4) Cannizaro reaction

Ans. (4)

In Cannizaro's reaction no new C–C bond is formed.

196. Which of the following pairs has the same size?

(1) Zr^{4+}, Hf^{4+}

(2) $Zn^{2+}; Hf^{4+}$

(3) Fe^{2+}, Ni^{2+}

(4) $Zr^{4+}; Ti^{4+}$

Ans. (1)

197. In a buffer solution containing equal concentration of B^- and HB, the K_b for B^- is 10^{-10}. The pH of buffer solution is

(1) 6
(2) 4
(3) 10
(4) 7

Ans. (2)

$$pOH = pKb + \log\frac{[salt]}{[base]}$$

$$pOH = 10 + \log 1$$

$$pH = 4$$

198. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?

(1) F < S < O < Cl
(2) S < O < Cl < F
(3) Cl < F < O < S
(4) O < S < F < Cl

Ans. (4)

O < S < F < Cl

199. Crystal field stabilization energy for high spin d^4 octahedral complex is

(1) $-1.2\ \Delta_0$
(2) $-0.6\ \Delta_0$

(3) $-1.8\ \Delta_0$
(4) $-1.6\ \Delta_0 + P$

Ans. (2)

$$CFSE = -\frac{3}{5}\Delta_0 = -0.6\Delta_0$$

200. Given are cyclohexanol (I), acetic acid (II), 2, 4, 6-trinitrophenol (III) and phenol (IV). In these the order of decreasing acidic character will be

(1) II > III > IV > I
(2) III > IV > II > I
(3) III > II > IV > I
(4) II > III > I > IV

Ans. (3)

III > II > IV > I