

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 are marine

Ans. (1)

2. Which one of the following statements about human sperm is incorrect?
- (1) Acrosome serves as 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 transport about 80 per cent oxygen only and the rest; 20 per cent of it is transported in dissolved state in blood plasma
  - (2) They do not carry CO<sub>2</sub> at all
  - (3) They carry about 20–25 per cent of CO<sub>2</sub>
  - (4) They do not carry CO<sub>2</sub> at all They carry about 20-25 per cent of CO<sub>2</sub> They transport 99.5 percent of O<sub>2</sub>

Ans. (3)

5. Which one of the following is used as vector for cloning genes into higher organisms?
- (1) *Rhizopus nigricans*

- (2) Retrovirus
- (3) Baculovirus
- (4) *Salmonella typhimurium*

Ans. (2)

6. Select the two correct 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) In the absence of lactose the repressor binds with the operator region
  - (3) The *z*-gene codes for permease
  - (4) This was elucidated by Francois Jacob and Jacques 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 nitrogenous 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 *correct*?

- (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 cytoplasm 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<sub>5</sub> and N<sub>2</sub>O
- (2) CO<sub>2</sub> and N<sub>2</sub>O
- (3) CO<sub>2</sub> and CH<sub>4</sub>
- (4) CH<sub>4</sub> and N<sub>2</sub>O

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 epithelium
- (2) squamous epithelium
- (3) cuboidal epithelium
- (4) columnar epithelium

Ans. (2)



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- (1) Karyogamy
- (2) Autogamy
- (3) Xenogamy
- (4) Geitonogamy

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. Select 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 technique 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) Mitochondrion

Ans. (1)

33. Phototropic curvature is the result of uneven distribution of:

- (1) Cytokinins
- (2) Auxin
- (3) Gibberellins
- (4) Phytohormone

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) Residual volume	2500 mL
(b) Vital capacity	3500 mL
(c) Inspiratory reserve	1200 mL
(d) Inspiratory capacity	4500 mL

Which one of the following is the *correct* matchign of two capacities and volumes?

- (1) (d) 3500 mL
- (2) (a) 4500 mL
- (3) (b) 2500 mL
- (4) (c) 1200 mL
- (a) 1200 mL
- (b) 3500 mL
- (c) 4500 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 *Bacillus* 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-suppressants 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 characteristic 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 nonconducting 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 some 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:

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- (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<sub>2</sub> 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

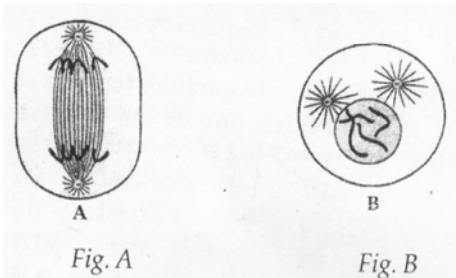
Ans. (3)

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 respectively?



- (1) Late Anaphase - Prophase
- (2) Prophase - Anaphase
- (3) Mataphase - Telophase

(4) Telophase - Metaphase

Ans. (1)

55. Study the four statements (a-d) given below and select the two *Correct* ones out of them :

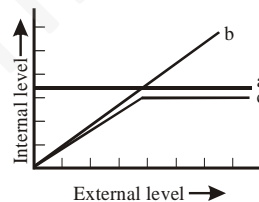
- (a) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
- (b) Predator star fish *Pisaster* helps in maintaining species diversity of some invertebrates
- (c) Predators ultimately lead to the extinction of prey species
- (d) Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders

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 likely to affect the secretion of which one of the following ?

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- (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 vaccine 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) Nataliy

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) *Beijerinckia*                      (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<sub>2</sub> generation.
- (2) Factors occur in pairs
- (3) The discrete unit controlling a particular character 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 pseudocoelomates
- (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 infection

Ans. (2)



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- (1) Nearly 99 per cent of the glomerular filtrate is reabsorbed by the renal tubules
- (2) Ascending limb of Loop of Henle is impermeable to electrolytes
- (3) Descending limb of Loop of Henle is impermeable to water
- (4) Distal convoluted tubule is incapable of reabsorbing  $\text{HCO}_3^-$

Ans. (1)

87. Some of the characteristics of Bt cotton are :

- (1) High yield and production of toxic protein crystals 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 molecule
- (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  $\text{Ca}^{++}$  in the body fluid may be the cause of :

- (1) Angina pectoris
- (2) Gout
- (3) Tetany
- (4) Anaemia

Ans. (3)

97. Carrier ions like  $\text{Na}^+$  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 :

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- (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)







106. A ray of light travelling in a transparent medium of refractive index  $\mu$ , falls on a surface separating the medium from air at an angle of incidence of  $45^\circ$ . for which of the following value of  $\mu$  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 carriers 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

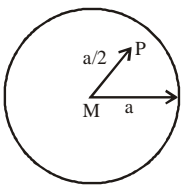
108. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be:

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

**Sol.:[3]**

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

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



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]**

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

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

110. A lens having focal length 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  $\Delta U$  and  $\Delta W$  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  $\Delta Q = 0$

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

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  $\vec{U}_{CM} = \vec{0}$

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

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

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]**

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

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

116. A source  $S_1$  is producing,  $10^{15}$  photons per second of wavelength  $5000\text{\AA}$ . Another source  $S_2$  is producing  $1.02 \times 10^{15}$  photons per second of wavelength  $5100\text{\AA}$ .

Then (power of  $S_2$ )/ (power of  $S_1$ ) is equal to

- (1) 1.04                              (2) 0.98
- (3) 1.00                              (4) 1.02

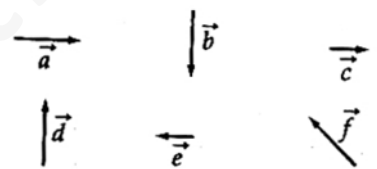
**Sol.:[3]**

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

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

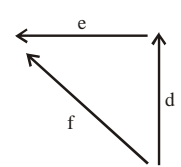
$\therefore \frac{P_2}{P_1} = \frac{n_2}{n_1} \times \frac{\lambda_1}{\lambda_2} = \frac{1.02 \times 10^{15}}{10^{15}} \times \frac{5000}{5100}$   
 $= \frac{2}{100} \times 50 = 1$

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  $y = A \sin(\omega t - kx)$ . 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)  $\pi A$

**Sol.:[1]**





- (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]

$$P = Fv$$

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

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

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

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<sup>-1</sup>. The induced emf when the radius is 2 cm, is:

- (1)  $\frac{\pi}{2} \mu V$
- (2) 2μV
- (3) 2πμV
- (4) πμV

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:

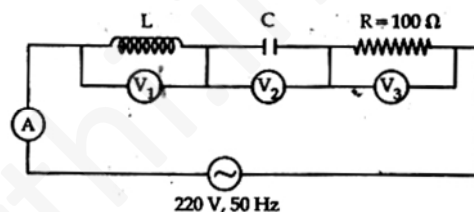
- (1) -2.4 V
- (2) 12 V
- (3) 2.4 V
- (4) -1.2V

Sol.:[4]

$$e|V_0| = \frac{hc}{\lambda} - \phi \Rightarrow eV_0 = \frac{12400eV\text{\AA}^\circ}{2000\text{\AA}^\circ} - 5.01eV$$

⇒ |V<sub>0</sub>| = 1.2 volt, but stopping potential is always -ve. So V<sub>0</sub> = -1.2 Volt

128. In the given circuit the reading of voltmeter V<sub>1</sub> and V<sub>2</sub> are 300 volts each. The reading of the voltmeter V<sub>3</sub> 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<sub>1</sub> = V<sub>2</sub> ⇒ IX<sub>L</sub> = IX<sub>C</sub>, so, X<sub>L</sub> = X<sub>C</sub>

circuit is in resonance. So V = V<sub>3</sub> = 220V and

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

129. A circular disk of moment of inertia I<sub>t</sub>, is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω<sub>i</sub>. Another disk of moment of inertia I<sub>b</sub> is dropped coaxially onto the rotating disk. Initially the second disk has zero angular speed. Eventually both the disks rotate with a constant angular speed ω<sub>f</sub>. 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)  $\frac{1}{2} \frac{I_t^2}{(I_t + I_b)} \omega_i^2$





Using conservation of angular momentum about central axis

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

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

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

putting  $\omega_f$  from (i)

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

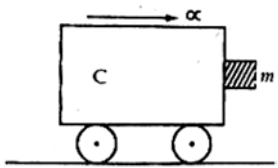
130. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass M is also suspended, the period of oscillation will now be:

- (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  $\mu$ . The acceleration  $\alpha$  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)  $\alpha > \frac{g}{\mu m}$

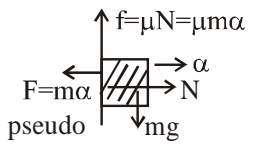
**Sol.:[1]**

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

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]**

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

$$R_{sc} = \left( \frac{V}{i_g R_g} - 1 \right) R_g$$

$$= \left( \frac{30}{30 \times 10^{-3} \times 100} - 1 \right) \times 100 = 900\Omega$$

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]**

$$Bqv = qE \dots(i)$$

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

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

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

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



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)  $5 \log_{10} 2$
- (2)  $5 \log_e 2$
- (3)  $\log_e 2/5$
- (4)  $\frac{5}{\log_e 2}$

**Sol.:[2]**

$$N = N_0 e^{-\lambda t}$$

$$\frac{N_0}{e} = N_0 e^{-\lambda \times 5}$$

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

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

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

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

**Sol.:[1]**

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

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

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

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

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]**

$$\eta = 0.8 = \frac{440 \times 2}{220 \times I}$$

$$I = 5A$$

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) (distance)<sup>-2</sup>
- (2) (velocity)<sup>2/3</sup>
- (3) (velocity)<sup>3/2</sup>
- (4) (distance)<sup>2</sup>

**Sol.:[3]**

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

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

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

139. The mass of a  ${}^7_3\text{Li}$  nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of  ${}^7_3\text{Li}$  nucleus is nearly:

- (1) 3.9 MeV
- (2) 26 MeV
- (3) 46 MeV
- (4) 5.6 MeV

**Sol.:[4]**

$$\frac{\text{B.E.}}{\text{nucleon}} = \frac{0.042 \times 931}{7} = 5.6 \text{ MeV}$$

140. The displacement of a particle along 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  $\omega/\pi$
- (4) simple harmonic motion of frequency  $3\omega/2\pi$

**Sol.:[3]**

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

141. The dimension of  $\frac{1}{2}\epsilon_0 E^2$ , where  $\epsilon_0$  is permittivity

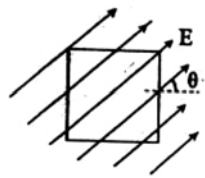
of free space and E is electric field, is

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

Sol.: [4]

$$\frac{1}{2}\epsilon_0 E^2 = \frac{\text{Energy}}{\text{volume}} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$

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  $\theta$  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]

$$\begin{aligned} \phi &= \vec{E} \cdot \vec{A} \\ &= EA \cos 90^\circ = 0 \end{aligned}$$

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) high 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]

$$\begin{aligned} \vec{P}_i &= \vec{P}_f \\ 0 &= 50V_1 - 0.5 \times 2 \end{aligned}$$

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

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

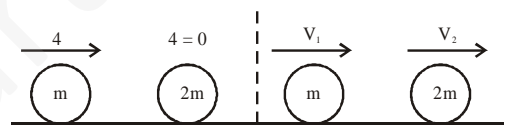
$$\text{Distance moved by man in 5 sec} = \frac{1}{50} \times 5 = \frac{1}{10} \text{ m}$$

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

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]



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

$$v_1 + 2v_2 = 2 \quad \dots(i)$$

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

$$v_2 - v_1 = 1 \quad \dots(ii)$$

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

$$v_1 = 0$$

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  $0.367 \times 10^{-6} \text{ Kg/C}$ )

- (1)  $17.61 \times 10^{-3} \text{ kg}$                       (2)  $3.67 \times 10^{-3} \text{ kg}$
- (3)  $1.76 \times 10^{-3} \text{ kg}$                       (4)  $9.67 \times 10^{-3} \text{ kg}$

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

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

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

- (1) 8.5 units                      (2) 10 units  
 (3) 7 units                        (4)  $7\sqrt{2}$  units

**Sol.:[4]**

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

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

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

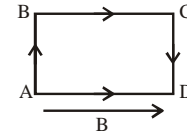
149. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is  $\vec{F}$ , the net force on the remaining three arms of the loops is :

- (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 decreases 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]**

$$f_T - f_p = 4$$

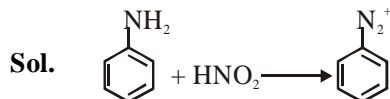
$$f_p = 508$$

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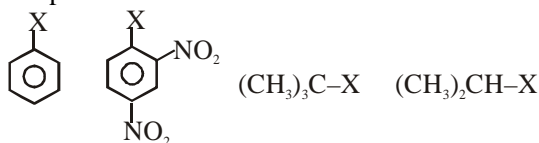
151. Which of the following statements about primary amines is 'False'?

- (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)



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



- (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<sub>a</sub> and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E<sub>a</sub> will be

- (1) more than ΔH
- (2) equal to zero
- (3) less than ΔH
- (4) equal to ΔH

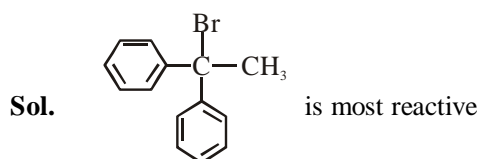
Ans. (4)

Sol. Minimum value of E<sub>a</sub> = ΔH

154. Which one is most reactive towards S<sub>N</sub><sup>1</sup> reaction?

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

Ans. (1)



155. Oxidation states of P in H<sub>4</sub>P<sub>2</sub>O<sub>5</sub>, H<sub>4</sub>P<sub>2</sub>O<sub>6</sub>, H<sub>4</sub>P<sub>2</sub>O<sub>7</sub>, are respectively

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

Ans. (2)

Sol. +3, +4, +5

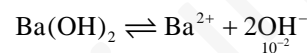
156. If pH of a saturated solution of Ba(OH)<sub>2</sub> is 12, the value of its K<sub>sp</sub> is

- (1) 5.00 × 10<sup>-6</sup> M<sup>3</sup>
- (2) 5.00 × 10<sup>-7</sup> M<sup>3</sup>
- (3) 4.00 × 10<sup>-6</sup> M<sup>3</sup>
- (4) 4.00 × 10<sup>-7</sup> M<sup>3</sup>

Ans. (2)

Sol. [H<sup>+</sup>] = 10<sup>-12</sup>

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



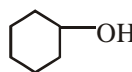
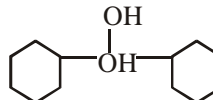
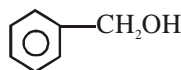
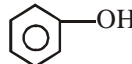
$$K_{sp} = [\text{Ba}^{2+}][\text{OH}^-]^2$$

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

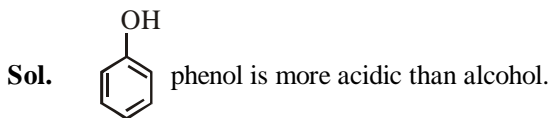
$$= 0.5 \times 10^{-2} \times 10^{-4}$$

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

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

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

Ans. (4)



158. Standard entropies of X<sub>2</sub>, Y<sub>2</sub> and XY<sub>3</sub> are 60, 40 and 50 J K<sup>-1</sup> mol<sup>-1</sup> respectively. For the reaction



$\frac{1}{2}X_2 + \frac{3}{2}Y_3 \rightleftharpoons XY_3, \Delta H = -30\text{kJ}$  to be at equi-

librium, the temperature should be

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

**Ans. (3)**  
**Sol.**

$$\Delta S = S_{\text{product}} - S_{\text{reactant}} \quad \left| \quad -40\text{J} = \Delta S \right.$$

$$= 50 - \left( \frac{1}{2} \times 60 + \frac{3}{2} \times 40 \right) \quad \left| \quad T = \frac{30 \times 10^3}{-40} = \frac{30,000}{40} \right.$$

159. Which of the following structures represents Neoprene polymer?

- (1)  $-(\text{CH}_2-\overset{\text{Cl}}{\text{CH}})_n-$
- (2)  $-(\overset{\text{C}_6\text{H}_5}{\text{CH}}-\text{CH}_2)_n-$
- (3)  $-(\text{CH}_2-\text{C}=\overset{\text{Cl}}{\text{CH}}-\text{CH}_2)_n-$
- (4)  $-(\text{CH}_2-\overset{\text{CN}}{\text{CH}})_n-$

**Ans. (3)**

**Sol.**  $-(\text{CH}_2-\overset{\text{Cl}}{\text{C}}=\text{CH}-\text{CH}_2)_n-$  is neoprene.

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

- (1)  $\text{NH}_2$  and  $\text{H}_2\text{O}$
- (2)  $\text{BF}_3$  and  $\text{NH}_2$
- (3)  $\text{NO}_2^-$  and  $\text{NH}_3$
- (4)  $\text{BF}_3$  and  $\text{NO}_2^-$

**Ans. (4)**

**Sol.**  $\text{BF}_3$  and  $\text{NO}_2^-$  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  $[\text{Ar}]3d^6$ ?

- (1)  $\text{Fe}^{3+}$
- (2)  $\text{Co}^{3+}$
- (3)  $\text{Ni}^{3+}$
- (4)  $\text{Mn}^{3+}$

**Ans. (2)**

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

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

- (1)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- (2)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- (3)  $[\text{Ni}(\text{CN})_4]^{2-}$
- (4)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$

**Ans. (3)**

**Sol.**  $[\text{Ni}(\text{CN})_4]^{2-}$  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 <sup>-1</sup>	[B]/mol L <sup>-1</sup>	Initial rate of formation of D/mol L <sup>-1</sup> min <sup>-1</sup>
I	0.1	0.1	$6.0 \times 10^{-3}$
II	0.3	0.2	$7.2 \times 10^{-2}$
III	0.3	0.4	$2.88 \times 10^{-1}$
IV	0.4	0.1	$2.40 \times 10^{-2}$

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

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



(4) rate = k[A][B]

**Ans.** (2)  
**Sol.** Rate law  $k[A][B]^2$

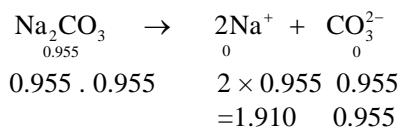
166. 25.3 g of sodium carbonate,  $\text{Na}_2\text{CO}_3$  is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion,  $\text{Na}^+$  and carbonate ions,  $\text{CO}_3^{2-}$  are respectively (Molar mass of  $\text{Na}_2\text{CO}_3 = 106 \text{ g mol}^{-1}$ )

- (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

$$\text{Na}_2\text{CO}_3 = \frac{25.3/100}{250} \times 100 = \frac{25.3 \times 1000}{106 \times 250} = 0.953$$



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)  $\text{SbCl}_5^{2-}$
- (2)  $\text{PCl}_5$

- (3)  $\text{SF}_4$
- (4)  $\text{I}_3$

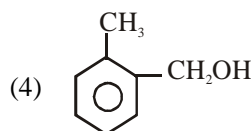
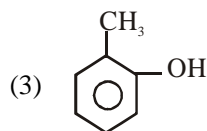
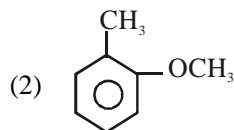
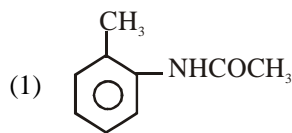
**Ans.** (1)  
 $\text{SbCl}_5^{2-}$  is  $\text{sp}^3\text{d}^2$  hybridised and rest three are  $\text{sp}^3\text{d}$  hybridised

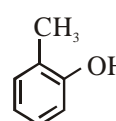
168. Which one of the following species does not exist under normal conditions?

- (1)  $\text{B}_2$
- (2)  $\text{Li}_2$
- (3)  $\text{Be}_2^+$
- (4)  $\text{Be}_2$

**Ans.** (4)  
Bond order of  $\text{Be}_2 = 0$ ; so under normal condition it does not exist

169. Which one is most reactive towards electrophilic reagent?



**Ans.** (3)  
 most activating.

170. For the reaction  $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$  the value of rate of disappearance of  $\text{N}_2\text{O}_5$  is given as  $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$ . The rate of formation of  $\text{NO}_2$  and  $\text{O}_2$  is given respectively as

- (1)  $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$  and  $3.125 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
- (2)  $1.25 \times 10^{-2} \text{ mol L}^{-1}\text{s}^{-1}$  and  $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
- (3)  $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$  and  $6.25 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$
- (4)  $1.25 \times 10^{-2} \text{ mol L}^{-1}\text{s}^{-1}$  and  $3.125 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$

**Ans.** (4)  
$$\frac{-d[\text{N}_2\text{O}_5]}{dt} = \frac{1}{2} \frac{d[\text{NO}_2]}{dt} = \frac{2d(\sigma_2)}{dt}$$

$$\frac{d(\text{N}_2\text{O}_5)}{dt} = 6.25 \times 10^{-3}$$

$$\frac{d(\text{NO}_2)}{dt} = 2 \times 6.25 \times 10^{-3} = 1.25 \times 10^{-2}$$

$$\frac{d[\text{O}_2]}{dt} = \frac{1}{2} \times 6.25 \times 10^{-3} = 3.125 \times 10^{-3}$$

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

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



Ans. (1)



172. AB crystallizes in a body centred cubic lattice with edge length 'a' equal to 387 pm. The distance between two oppositely 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  $CH_3COOH = 1.8 \times 10^{-5}$

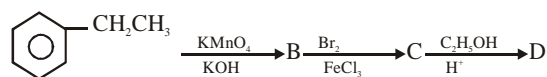
- (1)  $1.8 \times 10^{-5}$
- (2)  $9.0 \times 10^{-6}$
- (3)  $3.5 \times 10^{-4}$
- (4)  $1.1 \times 10^{-5}$

Ans. (2)

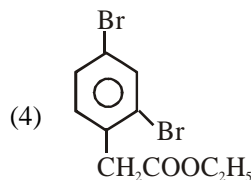
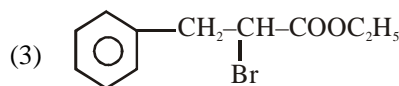
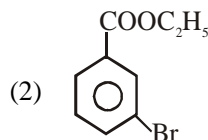
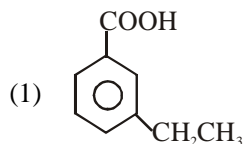
$$pH = pK_a + \log \frac{[\text{salt}]}{[\text{Acid}]} = 4.74 + \log \frac{0.2}{0.1} = 4.74 + 0.3 = 5.04$$

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

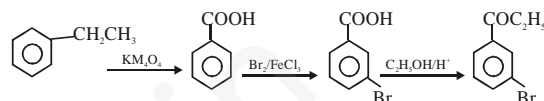
175. In a set of reactions, ethyl benzene yielded a product D



'D' would be



Ans. (2)



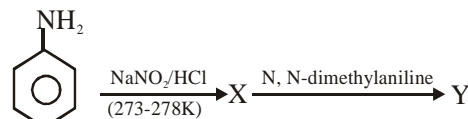
176. Which one of the following compounds is a peroxide?

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

Ans. (4)

$BaO_2$

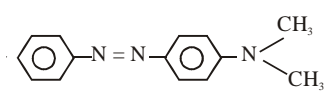
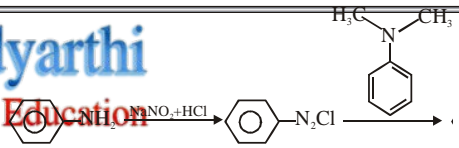
177. Aniline in a set of the following reactions yielded a coloured product 'Y'



The structure 'Y' would be

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

Ans. (3)

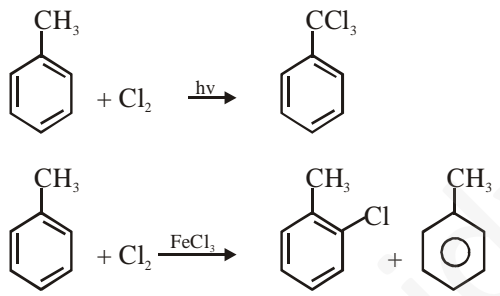


178. Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is
- (1)  $\text{CH}_3\text{COOCOCH}_3$
  - (2)  $\text{CH}_3\text{COCl}$
  - (3)  $\text{CH}_3\text{COOCH}_3$
  - (4)  $\text{CH}_3\text{CONH}_2$

**Ans. (2)**

179. The reaction of toluene with  $\text{Cl}_2$  in presence of  $\text{FeCl}_3$  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 Tran-  
quilizer 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)  $\text{B}_2\text{H}_6$
  - (2)  $\text{CH}_4$
  - (3)  $\text{NH}_3$
  - (4)  $\text{H}_2\text{O}$

**Ans. (1)**

$\text{B}_2\text{H}_6$  is Lewis acid

182. The number of atoms in 0.1 mol of a triatomic gas

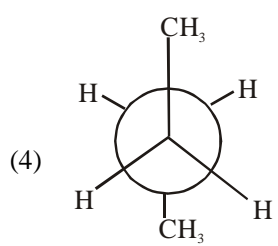
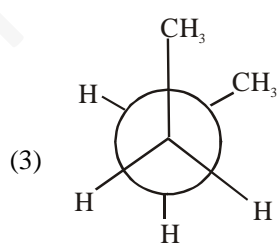
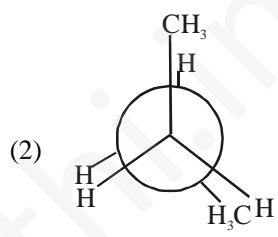
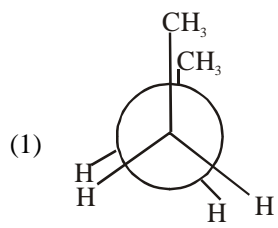
is : ( $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )

- (1)  $3.600 \times 10^{23}$
- (2)  $1.800 \times 10^{22}$
- (3)  $6.026 \times 10^{22}$
- (4)  $1.806 \times 10^{23}$

**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



**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.  $\text{H}_2\text{SO}_4$
- (2)  $\text{PCl}_5$



**FREE Education**

**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<sub>4</sub>  
 (2) SrSO<sub>4</sub>  
 (3) CaSO<sub>4</sub>  
 (4) BeSO<sub>4</sub>

**Ans. (4)**  
 BeSO<sub>4</sub>  
 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,  $\Delta G^\circ$  will ( $F = 96500 \text{ C mol}^{-1}$ )  
 (1) -44.5 kJ  
 (2) -98.0 kJ  
 (3) -89.0 kJ  
 (4) -89.0 J

**Ans. (3)**  
 $= -2 \times 96500 \times 0.46 = -88.78 = -89 \text{ kJ}$   
 188. A solution of sucrose (molar mass = 342 g mol<sup>-1</sup>) 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<sup>-1</sup>)  
 (1) +0.372°C  
 (2) -0.570°C  
 (3) -0.372°C  
 (4) +0.520°C

**Ans. (3)**  
 $\Delta T_f = kf.m = 1.86 \times \frac{68.5}{342 \times 100} \times 1000$   
 $= 0.372$   
 $T_f = 0 - 0.372 = -0.372^\circ\text{C}$

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<sub>2</sub>SO<sub>4</sub>

**Ans. (2)**  
 Addition of water cause the increase in vapour presence

192. The correct order of increasing bond angles in the following species is  
 (1) Cl<sub>2</sub>O < ClO<sub>2</sub><sup>-</sup> < ClO<sub>2</sub>  
 (2) ClO<sub>2</sub><sup>-</sup> < Cl<sub>2</sub>O < ClO<sub>2</sub>  
 (3) Cl<sub>2</sub>O < ClO<sub>2</sub> < ClO<sub>2</sub><sup>-</sup>  
 (4) ClO<sub>2</sub> < Cl<sub>2</sub>O < ClO<sub>2</sub><sup>-</sup>

**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<sub>3</sub>, BCl<sub>3</sub> and BBr<sub>3</sub> to behave as Lewis acid decreases in the sequence  
 (1) BBr<sub>3</sub> > BF<sub>3</sub> > BCl<sub>3</sub>  
 (2) BF<sub>3</sub> > BCl<sub>3</sub> > BBr<sub>3</sub>  
 (3) BCl<sub>3</sub> > BF<sub>3</sub> > BBr<sub>3</sub>



(4)  $BBF_3 > BCl_3 > BF_3$

Ans. (4)

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$BBF_3 > BF_3$  : 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)

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

$$pOH = 10 + \log 1$$

$$pH = 4$$

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)

$$III > II > IV > I$$