Maximum Marks: 720   **Time: 3 Hours**

Paper Code
Y

NEET (UG) – 2016

IMPORTANT INSTRUCTIONS

1. The Answer Sheet is inside the Test Booklet. When you arc directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on **side-1** and **side-2** carefully with blue/ black toll point pen only.

2. The test is of 3 hours duration and lest Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get **4** marks. For each incorrect response, **one mark** will be deducted from the total scores. The maximum marks are **720.**

3. Use **Blue/Black Ball Point Pen only** for writing particulars on this page / marking responses.

4. Rough work o to be done on the space provided for this purpose in the Test Booklet only.

5. **On completion of the test, the candidate must handover the Answer Sheet to the invigilator in the Room/Hall. The candidate are allowed to take away this Test Booklet with them**.

6. The CODE forth it Booklet is **S**. Make sure that the CODE printed on **Side-2** of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your roll no. anywhere else except in the specified space in the Test Booklet /vAnswer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admission Card to the Invigilator.

10. No candidates, without special permission of the Superintendent or Invigilator would leave his/her seat.

11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet the second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means ease.

12. Use of Electronic / Manual Calculator is prohibited

13. The candidates are governed by all Rules and Regulations of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

SECTION - I (BIOLOGY)   **360 MARKS**

1. In a testcross involving F_1 dihybrid flies, more parental-type offspring were produced than the recombinat-type offspring. This indicates:

    (1) Both of the characters are controlled by more than one gene.

    (2) The two genes are located on two different chromosomes

    (3) Chromosomes failed to separate during meiosis.

    (4) The two genes are linked and present on the same chromosome.

2. Water soluble pigments found in plant cell vacuoles are:

    (1) Anthocyanins   **(2)** Xanthophylls   **(3)** Chlorophylls   **(4)** Carotenoids

3. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other?

    (1) Relaxin - Inhibin   **(2)** Parathormone - Calcitonin

    (3) Insulin - Glucagon   **(4)** Aldosterone - Atrial Natriuretic factor

4. Mitochondria and chloroplast are:

    (a) semi-autonomous organelles.

    (b) formed by division of pre - existing organelles and they contain DNA but lack protein synthesizing machinery.

    Which one of the following options is correct?

    (1) Both (a) and (b) are false.   **(2)** Both (a) and (b) are correct.

    (3) (b) is true but (a) is false.   **(4)** (a) is true but (b) is false.

5. Which of the following is not a feature of the plasmids?

    (1) Single - stranded   **(2)** Independent replication

    (3) Circular structure   **(4)** Transferable

6. A plant in your garden avoids photorespiratory losses, has improved water use efficiency, shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilization. In which of the following physiological groups
    would you assign this plant?

    (1) Nitrogen fixer   **(2)** C_3 **(3)** C_4 **(4)** CAM

7. Emerson's enhancement effect and Red drop have been instrumental in the discovery of:

    (1) Oxidative phosphorylation

    (2) Photophosphorylation and non-cyclic electron transport

    (3) Two photosystems opera ting simultaneously

    (4) Photophosphorylation and cyclic electron transport

8. Which type of tissue correctly matches with its location?

Tissue	Location
(1) Cuboidal epithelium	Lining of stomach
(2) Smooth muscle	Wall of intestine
(3) Areolar tissue	Tendons
(4) Transitional epithelium	Tip of nose

9. When does the growth rate of a population following the logistic model equal zero? The logistic model is given as dN/dt = rN(l-N/K):

(1) when death rate is greater than birth rate.   (2) when N/ K is exactly one.

(3) When N nears the carrying capacity of the habitat   (4) when N/K equals zero.

10. Which one of the following statements is not true?

(1) Stored pollen in liquid nitrogen can be used in the crop breeding programmes

(2) Tapetum helps in the dehiscence of anther

(3) Exine of pollen grains is made up of sporopollenin

(4) Pollen grains of many species cause severe allergies

11. Which one of the following statements is wrong?

(1) Phycomycetes are also called algal fungi.   (2) Cyanobacteria are also called blue-green algae.

(3) Golden algae are also called desmids.   (4) Eubacteria are also called false bacteria.

12. The A vena curvature is used for bioassay of:

(1) Ethylene   (2) ABA   (3) GA_3 (4) IAA

13. Which of the following structures is homologus to the wing of a bird?

(1) Flipper of Whale   (2) Dorsal fin of a Shark

(3) Wing of a Moth   (4) Hind limb of Rabbit

14. Blood pressure in the pulmonary artery is:

(1) less than that in the venae cavae.   (2) same as that in the aorta.

(3) more than that in the carotid.   (4) more than that in the pulmonary vein.

15. Fertilization in humans is practically feasible only if:

(1) the sperms are transported into cervix within 48 hrs of release of ovum in uterus.

(2) the sperms are transported into vagina just after the release of ovum in fallopian tube,

(3) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the fallopian tube.

(4) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the cervix.

16. In meiosis crossing over is initiated at:

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

17. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the kingdom:

(1) Animalia   (2) Monera   (3) Protista   (4) Fungi

18. Lack of relaxation between successive stimuli in sustained muscle contraction is known as:

(1) Tonus   (2) Spasm   (3) Fatigue   (4) Tetanus

19. Identify the correct statement on 'inhibin':

(1) Is produced by nurse cells in testes and inhibits the secretion of LH.

(2) Inhibits the secretion of LH, FSH and Prolactin.

(3) Is produced by granulose cells in ovary and inhibits the secretion of FSH.

(4) Is produced by granulose cells in ovary and inhibits the secretion of LH.

20. Name the chronic respiratory disorder caused mainly by cigarette smoking:

(1) Respiratory alkalosis   **(2)** Emphysema   **(3)** Asthma   **(4)** Respirator)' acidosis

21. Which of the following most appropriately describes haemophilia?

(1) Dominant gene disorder   **(2)** Recessive gene d isorder

(3) X-linked recessive gene disorder   **(4)** Chromosomal disorder

22. Select the correct statement:

(1) The leaves of gymnosperms are not well adapted to extremes of climate

(2) Gymnosperms are both homosporous and heterosporous

(3) Salvinia, Ginkgo and Pinuf all are gymnosperms

(4) Sequoia is one of the tallest trees

23. Which of the following is required as inducer(s) for the expression of Lac operon?

(1) lactose and galactose   **(2)** glucose   **(3)** galactose   **(4)** lactose

24. A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F_1plants were selfed the resulting genotypes were in the ratio of :

(1) 3:1:: Dwarf: Tall

(2) 1:2:1:: Tall homozygous: Tall heterozygous : Dwarf

(3) 1:2:1:: Tall heterozygous: Tall homozygous : Dwarf

(4) 3:1:: Tall: Dwarf

25. Which part of the tobacco plant is infected by *Meloidogyite incognita* ?

(1) Root   **(2)** Flower   **(3)** Leaf   **(4)** Stem

26. Which of the following is not a characteristic feature during mitosis in somatic cells?

(1) Synapsis   **(2)** Spindle fibres

(3) Disappearance of nucleolus   **(4)** Chromosome movement

27. Which of the following statements is not true for cancer cells in relation to mutations?

(1) Mutations inhibit production of telomerase.   **(2)** Mutations in proto-oncogenes accelerate the cell cycle.

(3) Mutations destroy telomerase inhibitor.   **(4)** Mutations inactivate the cell control.

28. One of the major components of cell wall of most fungi is:

(1) Hemicellulose   **(2)** Chitin   **(3)** Peptidoglycan   **(4)** Cellulose

29. Cotyledon of maize grain is called:

(1) scutellum   **(2)** plumule   **(3)** coleorhiza   **(4)** coleoptile

30. Which of the following would appear as the pioneer organisms on bare rocks?

(1) Green algae   **(2)** Lichens   **(3)** Liverworts   **(4)** Mosses

31. Changes in GnRH pulse frequency in females is controlled by circulating levels of:

(1) progesterone and inhibin   **(2)** estrogen and progesterone

(3) estrogen and inhibin   **(4)** progesterone only

32. Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain:

(1) Attenuated pathogens

(2) Activated pathogens

(3) Harvested antibodies

(4) Gamma globulin

33. Photosensitive compound in human eye is made up of:

(1) Transducin and Retinene **(2)** Guanosine and Retinol

(3) Opsin and Retinal   **(4)** Opsin and Retinol

34. Specialised epidermal cells surrounding the guard cells are called:

(1) Lenticels

(2) Complementary cells

(3) Subsidiary cells

(4) Bulliform cells

35. Which of the following features is not present in the Phylum - Arthropoda?

(1) Jointed appendages

(2) Chitinous exoskeleton

(3) Metameric segmentation

(4) Parapodia

36. Reduction in pH of blood will:

(1) release bicarbonate ions by the liver.

(2) reduce the rate of heart beat.

(3) reduce the blood supply to the brain

(4) decrease the affinity of hemoglobin with oxygen.

37. Which of the following characteristic features always holds true for the corresponding group of animals ?

(1)	3 - chambered heart with one incompletely divided ventricle	Reptilia
(2)	Cartilaginous endoskeleton	Chondrichthyes
(3)	Viviparous	Mammalia
(4)	Possess a mouth with an upper and a lower jaw	Chordata

38. Match the terms in Column I with their description in Column II and choose the correct option:

Column I	Column II
(a) Dominance	(i) Many genes govern a single character
(b) Codominance	(ii) In a heterozygous organism only one allele expresses itself
(c) Pleiotropy	(iii) In a heterozygous organism both alleles express themselves fully
(d) Polygenic inheritance	(iv) A single gene influences many characters C

Code:

	(a)	(b)	(c)	(d)
(1)	(iv)	(iii)	(i)	(ii)
(2)	(ii)	(i)	(iv)	(iii)
(3)	(ii)	(iii)	(iv)	(i)
(4)	(iv)	(i)	(ii)	(iii)

39. A typical fat molecule is made up of:

(1) Three glycerol and three fatty add molecules

(2) Three glycerol molecules and one fatty acid molecule.

(3) One glycerol and three fatty acid molecules

(4) One glycerol and one fatty acid molecule

40. Proximal end of the filament of stamens attached to the:

(1) Thalamus or petal **(2)** Anther **(3)** Connective **(4)** Placenta

41. Which one of the following statements is wrong?

(1) Glycine is a sulphur containing amino acid.

(2) Sucrose is a disaccharide.

(3) Cellulose is a polysaccharide.

(4) Uracil is a pyrimidine.

42. Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using one of following options:

(1) One process occurs during day time, and the other at night.

(2) Both processes cannot happen simultaneously.

(3) Both processes can happen together because the diffusion coefficient of water and CO_2 is different

(4) The above processes happen only during nighttime.

43. A complex of ribosomes attached to a single strand of RNA is known as:

(1) Okazaki fragment **(2)** Polysome **(3)** Polymer **(4)** Polypeptide

44. Which one of the following is a characteristic feature of cropland ecosystem?

(1) Ecological succession **(2)** Absence of soil organisms

(3) Least genetic diversity **(4)** Absence of weeds

45. Which of the following is the most important cause of animals and plants being driven to extinction?

(1) Co - extinctions **(2)** Over-exploitation

(3) Alien species invasion **(4)** Habitat loss and fragmentation

46. In a chloroplast the highest number of protons is found in:

(1) Antennae complex **(2)** Stroma

(3) Lumen of thyiakoids **(4)** Inter membrane space

47. Which of the following is not required for any of the techniques of DNA fingerprinting available at present?

(1) DNA - DNA hybridization **(2)** Polymerase chain reaction

(3) Zinc finger analysis **(4)** Restriction enzymes

48. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the:

(1) Eubacteria **(2)** Halophiles **(3)** Thermoaddophiles **(4)** Methanogens

49. Which of the following features is not present in *Penplaneta americana*?

(1) Metamerically segmented body

(2) Schizocoelom as body cavity^

(3) Indeterminate and radial cleavage during embryonic development

(4) Exoskeleton composed of N-acetylglucosamine

50. A system of rotating crops with legume or grass pasture to improve soil structure and fertility is called:

(1) Shifting agriculture **(2)** Ley farming   **(3)** Contour farming   **(4)** Strip farming

51. Which of the following is wrongly matched in the given table?

	Microbe	Product	Application
(1)	Clostridium butylicum	Lipase	removal of oil stains
(2)	Trichoderma polysporum	Cyclosporin A	Immunosuppressive drug
(3)	Monascus purpureus	Statins	lowering of blood cholesterol
(4)	Streptococcus	Streptokinase	removal of clot from blood vessel

52. In mammals, which blood vessel would normally carry largest amount of urea?

(1) Hepatic Portal Vein **(2)** Renal Vein   **(3)** Dorsal Aorta   **(4)** Hepatic Vein

53. Pick out the corrcct statements:

(a) Haemophilia is a sex-linked recessive disease

(b) Down's syndrome is due to aneuploidy.

(c) Phenylketonuria is an autosomal recessive gene disorder.

(d) Sickle cell anaemia is an X - linked recessive gene disorder.

(1) (a), (b) and (c) are correct.   **(2)** (a) and (d) are correct.

(3) (b) and (d) are correct   **(4)** (a), (c) and (d) are correct

54. Which of the following guards the opening of hepatopancreatic duct into the duodenum?

(1) Sphincter of Oddi   **(2)** Semilunar valve   **(3)** Deocaecal valve   **(4)** Pyloric sphincter

55. Microtubules are the constituents of:

(1) Centrosome, Nucleosome and Centrioles   **(2)** Cilia, Flagella and Peroxisomes

(3) Spindle fibres, Centrioles and Cilia   **(4)** Centrioles, Spindle fibres and Chromatin

56. The coconut water from tender coconut represents:

(1) Free nuclear endosperm   **(2)** Endocarp

(3) Fleshy mesocarp   **(4)** Free nuclear pro embryo

57. Tricarpellary, syncarpous gynoecium is found in flowers of:

(1) Poaceae   **(2)** Liliaceae   **(3)** Solanaceae   **(4)** Fabaceae

58. Which of the following is not a stem modification?

(1) Flattened structures of Opuntia   **(2)** Pitcher of Nepenthes

(3) Thorns of citrus   **(4)** Tendrils of cucumber

59.　The taq polymerase enzyme is obtained from:

(1) *Pseudomonas putida*　　　　　　**(2)** *Thermtis aqttaticus*

(3) *Thiobacillus ferroxidans*　　　　**(4)** *Bacillus subtilis*

60.　Stems modified into flat green organs performing the functions of leaves are known as:

(1) Scales　　　**(2)** Cladodes　　　**(3)** Phyllodes　　　**(4)** Phylloclades

61.　In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to:

(1) Active immunity　　　　　　　　**(2)** Allergic response

(3) Graft rejection　　　　　　　　　**(4)** Auto-immune disease

62.　Nomenclature is governed by certain universal rules.

Which one of the following is contrary to the rules of nomenclature?

(1) When written by hand, the names are to be underlined

(2) Biological names can be written in any language

(3) The first word in a biological name represents the genus name, and the second is a specific epithet

(4) The names are written in Latin and are italicised

63.　In bryophytes and pteridophytes, transport of male gametes requires:

(1) Water　　　**(2)** Wind　　　**(3)** Insects　　　**(4)** Birds

64.　In context of Amniocentesis/ which of the following statement is incorrect?

(1) It can be used for detection of Cleft palate.

(2) It is usually done when a woman is between 14-16 weeks pregnant

(3) It is used for prenatal sex determination.

(4) It can be used for detection of Down syndrome.

65.　In the stomach, gastric ad£ is secreted by the:

(1) acidic cells　　　**(2)** gastrin secreting cells　　　**(3)** parietal cells　　　**(4)** peptic cells

66.　Spindle fibres attach on to:

(1) Kinetosome of the chromosome　　　**(2)** Telomere of the chromosome

(3) Kinetochore of the chromosome　　　**(4)** Centromere of the chromosome

67.　Which is the National Aquatic Animal of India?

(1) Sea - horse　　　**(2)** Gangetic shark　　　**(3)** River dolphin　　　**(4)** Blue whale

68.　Which one of the following cell organelles is enclosed by a single membrane?

(1) Nuclei　　　**(2)** Mitochondria　　　**(3)** Chloroplasts　　　**(4)** Lysosomes

69.　The two polypeptides of human insulin are linked together by:

(1) Disulphide bridges　　**(2)** Hydrogen bonds　　**(3)** Phosphodiester bond**(4)** Covalent bond

70.　In which of the following, all three are macronutrients?

(1) Nitrogen, nickel, phosphorus　　　　**(2)** Boron, zinc, manganese

(3) Iron, copper, molybdenum　　　　　**(4)** Molybdenum, magnesium, manganese

71. Which of the following statements is wrong for viroids?

(1) Their RNA is of high molecular weight   **(2)** They lack a protein coat

(3) They are smaller titan viruses   **(4)** They cause infections

72. Analogous structures are a result of:

(1) Stabilizing selection **(2)** Divergent evolution **(3)** Convergent evolution   **(4)** Shared ancestry

73. Select the incorrect statement:

(1) LH triggers secretion of androgens from the Leydig cells.

(2) FSH stimulates the Sertoli cells which help in sperrniogenesis.

(3) LH triggers ovulation in ovary

(4) LH and FSH decrease gradually during the follicular phase.

74. Which one of the following characteristics is not shared by birds and mammals?

(1) Warm blooded nature   **(2)** Ossified endoskeleton

(3) Breathing using lungs   **(4)** Viviparity

75. Which of the following statements is not correct?

(1) Some reptiles have also been reported as pollinators in some plant species

(2) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style.

(3) Insects that consume pollen or nectar without bringing about pollination are called pollen/nectar robbers

(4) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil.

76. Seed formation without fertilization in flowering plants involves the process of:

(1) Apomixis   **(2)** Sporulation   **(3)** Budding   **(4)** Somatic hybridization

77. Which of the following approaches does not give the defined action of contraceptive?

(1)	Vasectomy	prevents spermatogenesis
(2)	Barrier methods	prevent fertilization
(3)	Intra uterine devices	increase phagocytosis of sperms, suppress sperm motility and fertilizing capacity of sperms
(4)	Hormonal contraceptives	Prevent/retard entry of sperms, prevent ovulation and fertilization

78. The amino acid Tryptophan is the precursor for the synthesis of:

(1) Cortisol and Cortisone   **(2)** Melatonin and Serotonin

(3) Thyroxine and Triiodothyronine   **(4)** Estrogen and Progesterone

79. A river with an inflow of domestic sewage rich in organic waste may result in:

(1) Death of fish due to lack of oxygen.

(2) Drying of the river very soon due to algal bloom.

(3) Increased population of aquatic food web organisms.

**(4)** An increased production of fish due to biodegradable nutrients.

80. Gause's principle of competitive exclusion states that:

(1) Larger organisms exclude smaller ones through competition.

(2) More abundant species will exclude the less abundant species through competition.

(3) Competition for the same resources excludes species having different food preferences.

(4) No two species can occupy the same niche, indefinitely for the same limiting resources.

81. Asthma may be attributed to:

(1) accumulation of fluid in the lungs   (2) bacterial infection of the lungs

(3) allergic reaction of the mast cells in the lungs (4) inflammation of the trachea

82. The standard petal of a papilionaceous corolla is also called:

(1) Corona   (2) Carina   (3) Pappus   (4) Vexfllum

83. Which of the following is a restriction endonuclease?

(1) RNase   (2) Hind II   (3) Protease   (4) DNase

84. It is much easier for a small animal to run uphill than for a large animal, because:

(1) The efficiency of muscles in large animals is less than in the small animals.

(2) It is easier to carry a small body weight.

(3) Smaller animals have a higher metabolic rate

(4) Small animals have a lower O_2 requirement

85. Following are the two statements regarding the origin of life:

(a) The earliest organisms that appeared on the earth were non-green and presumably anaerobes.

(b) The first autotrophic organisms were the chemoautotrophs that never released oxygen.

Of the above statements which one of the following options is correct?

(1) Both (a) and (b) are false.   (2) (a) is correct but (b) is false.

(3) (b) is correct but (a) is false.   (4) Both (a) and (b) are correct

86. A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is containing more number of chromosomes as
compared to other dividing cells. This would result in:

(1) Polyteny   (2) Aneuploidy   (3) Polyploidy   (4) Somaclonal variation

87. Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancers:

(1) Methane   (2) Nitrous oxide   (3) Ozone   (4) Ammonia

88. Joint Forest Management Concept was introduced in India during:

(1) 1990s   (2) 1960s   (3) 1970s   (4) 1980s

89. Which one of the following is the starter codon?

(1) UAG   (2) AUG   (3) UGA.   (4) UAA

90. The term ecosystem was coined by:

(1) E. Wanning   (2) E.P.Odum   (3) A.G. Tansley   (4) E. Haeckel

SECTION - II (PHYSICS)   180 MARKS

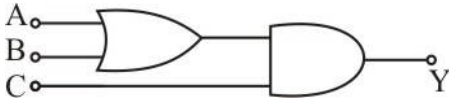**91.** What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop ?

(1) $\sqrt{5gR}$ (2) $\sqrt{gR}$ (3) $\sqrt{2gR}$ (4) $\sqrt{3gR}$

92. If the magnitude of sum of two vectors is equal to the magnitude difference of the two vectors, the angle between these vectors is :

(1) 180°   (2) 0°   (3) 90°   (4) 45°

93. At what height from the surface of earth the gravitation potential and the value of g are $-5.4 \times 10^7 \, \text{J kg}^{-2}$ and $6.0 \, \text{ms}^{-2}$ respectively? Take the radius of earth as 6400 km :

(1) 2000 km   (2) 2600 km   (3) 1600 km   (4) 1400 km

94. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} \, \text{Wb}$. The self-inductance of the solenoid is :

(1) 1 H   (2) 4 H   (3) 3 H   (4) 2 H

95. An inductor 20 mH, a capacitor 50 µF and a resistor 40 Ω are connected in series across a source of emf V = 10 sin 340 t. The power loss in A.C. circuit is:

(1) 0.89 W   (2) 0.51 W   (3) 0.67 W   (4) 0.76 W

96. Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance $d (d \ll l)$ apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. The v varies as a function of the distance x between the spheres, as :

(1) $v \propto x^{-1}$ (2) $v \propto x^{\frac{1}{2}}$ (3) $v \propto x$ (4) $v \propto x^{-\frac{1}{2}}$

97.
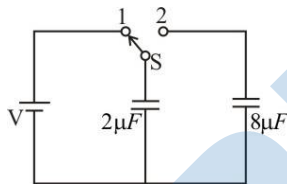
A capacitor of 2µF is charged as shown in the diagram. When the switch S is turned to position 2, the percentage of its stored energy dissipated is :

(1) 80%   (2) 0%   (3) 20%   (4) 75%

98. A particle moves so that its position vector is given by $\vec{r} = \cos \omega t \, \hat{x} + \sin \omega t \, \hat{y}$. Where ω is a constant.

Which of the following is true?

(1) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.

(2) Velocity and acceleration both are perpendicular to $\vec{r}$.

(3) Velocity and acceleration both are parallel to $\vec{r}$.

(4) Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin.

99. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre ?

(1) $9 MR^2/32$ **(2)** $15 MR^2/32$ **(3)** $13 MR^2/32$ **(4)** $11 MR^2/32$

100. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p) whose radius and mean density are twice as that of earth is :

(1) $1:\sqrt{2}$ **(2)** $1:2$ **(3)** $1:2\sqrt{2}$ **(4)** $1:4$

101. A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is :

(1) $3:2$ **(2)** $5:1$ **(3)** $5:4$ **(4)** $3:4$

102. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of 15 ms^{-1}. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is :

(Take velocity of sound in air = 330 ms^{-1})

(1) 885 Hz **(2)** 765 Hz **(3)** 800 Hz **(4)** 838 Hz

103. To get output 1 for the following circuit, the correct choice for the input is :

(1) A = 1, B = 0, C = 1 **(2)** A = 0, B = 1, C = 0

(3) A = 1, B = 0, C = 0 **(4)** A = 1, B = 1, C = 0

104. In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle 30° when light of wavelength 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of :

(1) $\sin^{-1}\left(\dfrac{3}{4}\right)$ **(2)** $\sin^{-1}\left(\dfrac{1}{4}\right)$ **(3)** $\sin^{-1}\left(\dfrac{2}{3}\right)$ **(4)** $\sin^{-1}\left(\dfrac{1}{2}\right)$

105. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\dfrac{V}{4}$. The threshold wavelength for the metallic surface is :

(1) 3λ **(2)** 4λ **(3)** 5λ **(4)** $\dfrac{5}{2}\lambda$

106. When an α-particle of mass 'm' moving with velocity 'v' bombards on a heavy nucleus of charge 'Ze', its distance of closest approach from the nucleus depends on m as :

(1) m **(2)** $\dfrac{1}{m}$ **(3)** $\dfrac{1}{\sqrt{m}}$ **(4)** $\dfrac{1}{m^2}$

107. Match the corresponding entries of column 1 with column 2. 'Where m is the magnification produced by the mirror]

Column 1	Column 2
(A) m = –2	(a) Convex mirror

(B) $m = -\dfrac{1}{2}$ (b) Concave mirror

(C) $m = +2$ (c) Real image

(D) $m = +\dfrac{1}{2}$ (d) Virtual image

(1) A→c and d;   B→b and d;   C→b and c;   D→a and d

(2) A→b and c;   B→b and c;   C→b and d;   D→a and d

(3) A→a and c;   B→a and d;   C→a and b;   D→c and d

(4) A→c and d;   B→b and c;   C→b and d;   D→b and c

108. A particle of mass 10 g moves along a circular of radius 64 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to $8 \times 10^{-4}\,J$ by the end of the second revolution after the beginning of the motion ?

  (1) 0.2 m/s^2 (2) 0.1 m/s^2 (3) 0.15 m/s^2 (4) 0.18 m/s^2

109. A small signal voltage V(t) = $V_0 \sin \omega t$ is applied across and ideal capacitor C :

  (1) Current I(t) leads voltage V(t) by 180°

  (2) Current I(t), lags voltage V(t) by 90°

  (3) Over a full cycle the capacitor C does not consume any energy from the voltage source. Current I(t) is in phase with voltage V(t).

  (4) Current I(t) is in phase with voltage V(t)

110. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first ?

  (1) Depends on their masses   (2) Disk

  (3) Sphere   (4) Both reach at the same time

111. Coefficient of linear expansion of brass and steel road are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good ?

  (1) $\alpha_1 l_1 = \alpha_2 l_2$ (2) $\alpha_1 l_2 = \alpha_2 l_1$ (3) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (4) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

112. A astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance :

  (1) 54.0 cm   (2) 37.3 cm   (3) 46.0 cm   (4) 50.0 cm

113. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad s^{-2}. Its net acceleration in ms^{-2} at the end of 2.0 s is a approximately.

  (1) 3.0   (2) 8.0   (3) 7.0   (4) 6.0

114. A refrigerator works between 4°C and 30°C. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is : (Take 1 cal = 4.2 Joules)

  (1) 2365 W   (2) 2.365 W   (3) 23.65 W   (4) 236.5 W

115. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then :

(1) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

(2) Compressing the gas isothermally will require more work to be done.

(3) Compressing the gas through adiabatic process will require more work to be done.

(4) Compressing the gas isothermally or adiabatically will require the same amount of work.

116. The intensity at the maximum in a Young's double slit experiment is I_0. Distance between two slits is $d = 5\lambda$, where λ is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen place at a distance $D = 10d$?

(1) $\dfrac{I_0}{2}$ **(2)** I_0 **(3)** $\dfrac{I_0}{4}$ **(4)** $\dfrac{3}{4}I_0$

117. Two non-mixing liquids of densities ρ and $n\rho (n > 1)$ are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length $pL(p < 1)$ in the denser liquid. The density d is equal to :

(1) $\{1 + (n-1)\}p/\rho$ **(2)** $\{1 + (n+1)\}p/\rho$ **(3)** $\{2 + (n+1)\}p/\rho$ **(4)** $\{2 + (n-1)\}p/\rho$

118. Consider the junction diode as ideal. The value of current flowing through AB is :

(1) 10^{-3} A **(2)** 0 A **(3)** 10^{-2} A **(4)** 10^{-1} A

119. A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is :

(1) $\sqrt{\dfrac{g}{R^2}\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$ **(2)** $\sqrt{gR^2\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$ **(3)** $\sqrt{gR\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$ **(4)** $\sqrt{\dfrac{g}{R}\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

120. A long straight wire of radius a carries a steady current I. The current uniformly distributed over its cross – section. The ratio of the magnetic fields B and B', at radial distances $\dfrac{a}{2}$ and 2a respectively, form the axis of the wire is :

(1) 4 **(2)** $\dfrac{1}{4}$ **(3)** $\dfrac{1}{2}$ **(4)** 1

121. Given the value of Rydberg constant is 10^7 m^{-1}, the wave number of the last line of the Balmer series in hydrogen spectrum will be:

(1) 2.5×10^7 m^{-1} **(2)** 0.025×10^4 m^{-1} **(3)** 0.5×10^7 m^{-1} **(4)** 0.25×10^7 m^{-1}

122. Ii the velocity of a particle is $v = At + Bt^2$, where A and B are constants, then the distance travelled by it between Is and 2s is :

(1) $\dfrac{A}{B} + \dfrac{B}{3}$ **(2)** $\dfrac{3}{2}A + 4B$ **(3)** $3A + 7B$ **(4)** $\dfrac{3}{2}A + \dfrac{7}{3}B$

123. The angle of incidence for a rayof lightata refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are

(1) $30°; \dfrac{1}{\sqrt{2}}$ **(2)** $45°; \dfrac{1}{\sqrt{2}}$ **(3)** $30°; \sqrt{2}$ **(4)** $45°; \sqrt{2}$

124. 124. The molecules of a given mass of a gas have r.m.s. velocity of 200 ms⁻¹ at 27°C and 1.0×10^5 Nm⁻² pressure. When the temperature and pressure of the gas are respectively, 127°C and 0.05×10^5 Nm⁻². the r.m.s. velocity of its molecules in ms⁻¹ is:

(1) $\dfrac{100}{3}$ **(2)** $100\sqrt{2}$ **(3)** $\dfrac{400}{\sqrt{3}}$ **(4)** $\dfrac{100\sqrt{2}}{3}$

125. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is:

(1) 200 cm   **(2)** 66.7 cm   **(3)** 100 cm   **(4)** 150 cm

126. The magnetic susceptibility is negative for :

(1) paramagnetic and ferromagnetic materials   **(2)** diamagnetic material only

(3) paramagnetic material only   **(4)** ferromagnetic material only

127. An electron or mass m and a photon have same energy E The ratio of de-Broglie wavelengths associated with them is

(1) $\dfrac{1}{c}\left(\dfrac{2m}{E}\right)^{\frac{1}{2}}$ **(2)** $\dfrac{1}{c}\left(\dfrac{E}{2m}\right)^{\frac{1}{2}}$ **(3)** $\left(\dfrac{E}{2m}\right)^{\frac{1}{2}}$ **(4)** $c\left(2eE\right)^{\frac{1}{2}}$

128. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = (2t\hat{i} + 2t^2\hat{j})N$, where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. What power will be developed by the force at the time t?

(1) $(2t + 3t^5)W$ **(2)** $(2t^2+3t^3)W$ **(3)** $(2t^2+4t^4)$ W   **(4)** $(2t^3+3t^4)W$

129. The charge flowing through a resistance R varies with time t as $Q = at - bt^2$, where a and b are positive constants. The total heat produced in R is :

(1) $\dfrac{a^3R}{b}$ **(2)** $\dfrac{a^3R}{6b}$ **(3)** $\dfrac{a^3R}{3b}$ **(4)** $\dfrac{a^3R}{2b}$

130. A npn transistor is connected in common emitter configuration in a given amplifier. A load resistance of 800 Ω is connected in the collector circuit and the voltage drop across-it is 0.8 V. If the current amplification factor is 0.96 and the input resistance of the circuit is 192 Ω, the voltage gain and the power gain of the amplifier will respectively be:

(1) 4,3.69   **(2)** 4, 3.84   **(3)** 3.69,3.84   **(4)** 4, 4

131. A piece of ice falls from a height h so that it melts com pletely. Only one - quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is:

[Latent heat of ice is 3.4×10^5 J/ kg and g = 10 N/ kg]

(1) 68 km   **(2)** 34km   **(3)** 544km   **(4)** 136 km

132. A square loop A BCD carrying a current *i*, is placed near and coplanar with a long straight conductor XV carrying a current I, the net force on the loop will
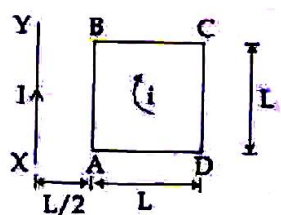
(1) $\dfrac{\mu_0 IiL}{2\pi}$ **(2)** $\dfrac{2\mu_0 Ii}{2\pi}$ **(3)** $\dfrac{\mu_0 Ii}{2\pi}$ **(4)** $\dfrac{2\mu_0 IiL}{3\pi}$

133. A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2, is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the puLse when it reaches the top of the rope is A_2. The ratio λ_2/λ_1 is:

(1) $\sqrt{\dfrac{m_1 + m_2}{m_1}}$ **(2)** $\sqrt{\dfrac{m_1}{m_2}}$ **(3)** $\sqrt{\dfrac{m_1 + m_2}{m_2}}$ **(4)** $\sqrt{\dfrac{m_2}{m_1}}$

134. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, b = 2.88x 10® nmK. Which of the following is correct ?

(1) $U_2 > U_1$ **(2)** $U_1 = 0$ **(3)** $U_3 = 0$ **(4)** $U_1 > U_2$

135. Out of the following options which one can be used to produces propagating electromagnetic wave?

(1) An accelerating charge   **(2)** A charge moving at constant velocity

(3) A stationary charge   **(4)** A chargeless particle

SECTION - III (CHEMISTRY)   180 MARKS

136.[E] Which one of the following characteristics is associated with adsorption?

(1) ΔG and ΔS are negative but ΔH is positive   **(2)** ΔG is negative but ΔH and ΔS are positive

(3) ΔG, ΔH and ΔS all are negative   **(4)** ΔG and ΔH are negative but ΔS is positive

137.[M] The pressure of H_2 required to make the potential of H_2-electrode zero in pure water at 298 K is

(1) 10^{-4} atm   **(2)** 10^{-14} atm   **(3)** 10^{-12} atm   **(4)** 10^{-10} atm

138.[E] The addition of a catalyst during a chemical reaction alters which of the following quantities?

(1) Activation energy   **(2)** Entropy   **(3)** Internal energy   **(4)** Enthalpy

139.[E] For the following reactions

(a) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH = CH_2 + KBr + H_2O$

(b)

(c)

Which of the following statements is correct?

(1) (a) is substitution, (b) and (c) are addition reactions.

(2) (a) and (b) are elimination reactions and (c) is addition reaction.

(3) (a) is elimination, (b) is substitution and (c) is addition reaction.

(4) (a) is elimination, (b) and (c) are substitution reactions.

140.[E] The product formed by the reaction of an aldehyde with a primary amine is

(1) Aromatic acid   **(2)** Schiff base   **(3)** Ketone   **(4)** Carboxylic acid

141.[M] The correct statement regarding the basicity of arylamines is

(1) Arylamines are generally more basic than alkylamines, because the nitrogen atom in arylamines is sp-hybridized.

(2) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.

(3) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring π electron system.

(4) Arylamines are generally more basic than alkylamines because of aryl group.

142.[E] Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape?

(1) 1/2   **(2)** 1/8   **(3)** 1/4   **(4)** 3/8

143.[E] The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is

(1) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

(2) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.

(3) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.

(4) The eclipsed conformation of ethane is more stable than staggered conformation even through the eclipsed conformation has torsional strain.

144.[M] In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

(1) Li < Na < K < Rb (increasing metallic radius)

(2) Al^{3+} < Mg^{2+} < Na^+ < F^- (increasing ionic size)

(3) B < C < N < O (increasing first ionization enthalpy)

(4) I < Br < Cl < F (increasing electron gain enthalpy)

145.[E] The rate of a first-order reaction is 0.04 mol $l^{-1}s^{-1}$ at 10 seconds are 0.03 mol $l^{-1}s^{-1}$ at 20 seconds after initiation of the reaction. The half-life period of the reaction is

(1) 54.1 sec   **(2)** 24.1 sec   **(3)** 34.1 sec   **(4)** 44.1 sec

146.[M] When copper is heated with conc. HNO_3 it produces:

(1) $Cu(NO_3)_2$ and N_2O **(2)** $Cu(NO_3)_2$ and NO_2

(3) $Cu(NO_3)_2$ and NO **(4)** $Cu(NO_3)_2$, NO and NO_2

147.[E] In a protein molecule, various amino acids are linked together by

(1) dative bond   **(2)** α-glycosidic bond   **(3)** β-glycosidic bond   **(4)** peptide bond

148.[E] Fog is a colloidal solution of

     (1) Gas in gas   **(2)** Liquid in gas   **(3)** Gas in liquid   **(4)** solid in gas

149.[M] Match items of Column I with the items Column II and assign the correct code

Column I	Column II
(a) Cyanide process	(i) Ultrapure Ge
(b) Froth floatation process	(ii) Dressing of ZnS
(c) Electrolytic reduction	(iii) Extraction of A
(d) Zone refining	(iv) Extraction of A
	(v) Purification of

Code:

	(a)	(b)	(c)	(d)
(1)	(iii)	(iv)	(v)	(i)
(2)	(iv)	(ii)	(iii)	(i)
(3)	(ii)	(iii)	(i)	(v)
(4)	(i)	(ii)	(iii)	(iv)

150.[M] Which one given below is a non-reducing sugar?

     (1) Sucrose   **(2)** Maltose   **(3)** Lactose   **(4)** Glucose

151.[E] The correct statement regarding RNA and DNA respectively is:

     (1) The sugar component in RNA 2'-deoxyribose and the sugar component DNA is arabinose.

     (2) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose

     (3) The sugar component in RNA is ribose the sugar component in DNA 2'-deoxyribose.

     (4) The sugar component in RNA is arabinose and the sugar component in DNA is ribose

152.[E] The correct thermodynamic conditions for spontaneous reaction at all temperatures is

     (1) $\Delta H < 0$ and $\Delta S < 0$ **(2)** $\Delta H <$ and $\Delta S = 0$ **(3)** $\Delta H > 0$ and $\Delta S < 0$ **(4)** $\Delta H < 0$ and $\Delta S > 0$

153.[D] Which is the correct statement for the given acids?

     (1) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid

     (2) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid

     (3) Both are diprotic acids   **(4)** Both are triprotic acids.

154.[M] MY and NY_3, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be true in regard to MY and NY_3?

     (1) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities.

     (2) The molar solubilities of MY and NY_3 in water are identical.

     (3) The molar solubility of MY in water is less than that of NY_3.

     (4) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water.

155.[E] Which of the following is an analgesic?

(1) Chloromycetin   **(2)** Novalgin   **(3)** Penicillin   **(4)** Streptomycin

156.[E] The pair of electrons in the given carbanion, $CH_3C \equiv C^{\ominus}$ is present in which of the following orbitals?

(1) sp   **(2)** 2p   **(3)** sp^3 **(4)** sp^2

157.[M] Among the following, the correct order of acidity is

(1) $HClO_4 < HClO_2 < HClO < HClO_3$ **(2)** $HClO_3 < HClO_4 < HClO_2 < HClO$

(3) $HClO < HClO_2 < HClO_3 < HClO_4$ **(4)** $HClO_2 < HClO < HClO_3 < HClO_4$

158.[E] Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution?

(1) Green $Cr_2(SO_4)_3$ is formed.   **(2)** The solution turns blue

(3) The solution is decolorized   **(4)** SO_2 is reduced

159.[E] Predict the correct order among the following

(1) lone pair – bond pair > bond pair – bond pair > lone pair – lone pair

(2) lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

(3) lone pair – lone pair > bond pair – bond pair > lone pair – bond pair

(4) bond pair – bond pair > lone pair – bond pair > lone pair – lone pair

160.[E] Two electrons occupying the same orbital are distinguished by

(1) Spin quantum number   **(2)** Principal quantum number

(3) Magnetic quantum number   **(4)** Azimuthal quantum number

161.[M] The product obtained as a result of a reaction of nitrogen with CaC_2 is

(1) Ca_2CN **(2)** $Ca(CN)_2$ **(3)** $CaCN$ **(4)** $CaCN_3$

162.[D] Natural rubber has

(1) Random cis-and trans-configuration   **(2)** All cis-configuration

(3) All trans-configuration   **(4)** Alternate cis-and trans – configuration

163.[E] Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

(1) $F_2 > Cl_2 > Br_2 > I_2$ **(2)** $I_2 > Br_2 > Cl_2 > F_2$ **(3)** $Cl_2 > Br_2 > F_2 > I_2$ **(4)** $Br_2 > I_2 > F_2 > Cl_2$

164.[E] The reaction

Can be classified as

(1) Williamson alcohol synthesis reaction   **(2)** Williamson ether synthesis reaction

(3) Alcohol formation reaction   **(4)** Dehydration reaction

165.[M] Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1}. Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23}$ mol^{-1})

**(1)** 264 pm   **(2)** 154 pm   **(3)** 352 pm   **(4)** 527 pm

166.[E] The ionic radii of A^+ and B^- ions are 0.98×10^{-10} m and 1.81×10^{-10} m. The coordination number of each ion in AB is

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

167.[E] At 100°C the vapor pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be

(1) 103°C   (2) 101°C   (3) 100°C   (4) 102°C

168.[D] The electronic configurations of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (atomic No. 65) are

(1) $[Xe]4f^7 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(2) $[Xe]4f^7 6s^2$, $[Xe]4f^8 6d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

(3) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(4) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

169.[E] Which of the following statements about hydrogen is incorrect?

(1) Dihydrogen does not act as a reducing agent

(2) Hydrogen has three isotopes of which tritium is the most common

(3) Hydrogen never acts as cation in ionic salts.

(4) Hydronium ion, H_3O^+ exists freely in solution.

170.[M] In the reaction $H-C \equiv CH \xrightarrow[\text{(2) } CH_3CH_2Br]{\text{(1) } NaNH_2 / \text{liq. } NH_3} X \xrightarrow[\text{(2) } CH_3CH_2Br]{\text{(1) } NaNH_2 / \text{liq. } NH_3} Y$, X and Y are

(1) X = 1-Butyne; Y = 2-Hexyne   (2) X = 1-Butyne; Y = 3-Hexyne

(3) X = 2-Butyne; Y = 3-Hexyne   (4) X = 2-Butyne; Y = 2-Hexyne

171.[M] Consider the following liquid – vapour equilibrium.

$$\text{Liquid} \rightleftharpoons \text{Vapour}$$

Which of the following relations is correct?

(1) $\dfrac{d\ln P}{dT} = \dfrac{\Delta H_v}{RT^2}$ (2) $\dfrac{d\ln G}{dT^2} = \dfrac{\Delta H_v}{RT^2}$ (3) $\dfrac{d\ln P}{dT} = \dfrac{-\Delta H_v}{RT}$ (4) $\dfrac{d\ln P}{dT^2} = \dfrac{-\Delta H_v}{T^2}$

172.[M] Which of the following statements about the composition of the vapour over an ideal 1: 1 molar mixture of benzene and toluene is correct? Assume that the temperature is constant at 25°C. (Given, Vapour pressure data at 25°C, benzene = 12.8 kPa, toluene = 3.85 kPa)

(1) Not enough information is given to make a prediction

(2) The vapour will contain a higher percentage of benzene

(3) The vapour will contain a higher percentage of toluene

(4) The vapour will contain equal amounts of benzene and toluene.

173.[D] Which of the following biphenyls is optically active?
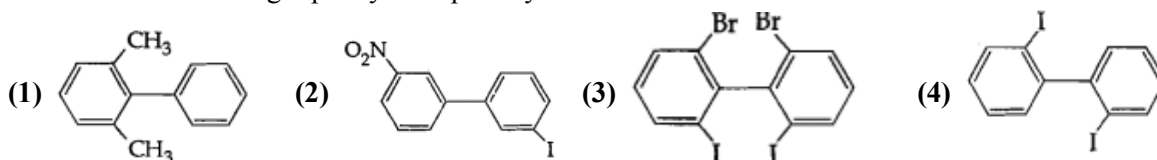
174.[M] Which of the following reagents would distinguish cis-cyclopenta-1, 2-diol from the trans-isomer?

    (1) Aluminium isopropoxide   **(2)** Acetone

    (3) Ozone   **(4)** MnO_2

175.[D] The correct statement regarding a carbonyl compound with a hydrogen atom on its alpha carbon, is

    (1) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

    (2) A carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.

    (3) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.

    (4) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation.

176.[E] Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false?

    (1) The H – C – H bond angle in CH_4 is larger than the H – N – H bond angle in NH_3

    (2) The H – C – H bond angle in CH_4, the H – N – H bond angle in NH_3, and the H – O – H bond angle in H_2O are all greater than 90°.

    (3) The H – O – H bond angle in H_2O is larger than the H – C – H bond angle in CH_4

    (4) The H – O – H bond angle in H_2O is smaller than the H – N – H bond angle in NH_3.

177.[E] Match the compounds given in Column I with the hybridization and shape given in Column II and mark the correct option

Column I	Column II
(a) XeF_6	(i) Distorted octahedral
(b) XeO_3	(ii) Square planar
(c) $XeOF_4$	(iii) Pyramidal
(d) XeF_4	(iv) Square pyramidal

Code

	(a)	(b)	(c)	(d)
(1)	(iv)	(i)	(ii)	(iii)
(2)	(i)	(iii)	(iv)	(ii)
(3)	(i)	(ii)	(iv)	(iii)
(4)	(iv)	(iii)	(i)	(ii)

178.[M] Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of nitration will be

    (1) Doubled   **(2)** Faster   **(3)** Slower   **(4)** Unchanged

179.[M] Which of the following statements is false?

    (1) Mg^{2+} ions are important in the green parts of plants.

    (2) Mg^{2+} ions form a complex with ATP   **(3)** Ca^{2+} ions are important in blood clotting

    (4) Ca^{2+} ions are not important in maintaining the regular beating of the heart.

180.[D] Which of the following has longest C – O bond length? (Free C – O bond length in CO is 1.128 Å).

    (1) $\left[Mn(CO)_6\right]^+$ **(2)** $Ni(CO)_4$ **(3)** $\left[Co(CO)_4\right]^-$ **(4)** $\left[Fe(CO)_4\right]^{2-}$

NEET 2016 : Paper Code

Y

ANSWER KEY

BIOLOGY				PHYSICS		CHEMISTRY	
1.	(4)	46.	(3)	91.	(1)	136.	(3)
2.	(1)	47.	(3)	92.	(3)	137.	(2)
3.	(1)	48.	(4)	93.	(2)	138.	(1)
4.	(4)	49.	(3)	94.	(1)	139.	(3)
5.	(1)	50.	(2)	95.	(2)	140.	(2)
6.	(3)	51.	(1)	96.	(4)	141.	(2)
7.	(3)	52.	(4)	97.	(1)	142.	(2)
8.	(2)	53.	(1)	98.	(4)	143.	(1)
9.	(2)	54.	(1)	99.	(3)	144.	(3 & 4)
10.	(2)	55.	(3)	100.	(3)	145.	(2)
11.	(4)	56.	(1)	101.	(1)	146.	(2)
12.	(4)	57.	(2)	102.	(4)	147.	(4)
13.	(1)	58.	(2)	103.	(1)	148.	(2)
14.	(4)	59.	(2)	104.	(1)	149.	(2)
15.	(3)	60.	(4)	105.	(1)	150.	(1)
16.	(2)	61.	(4)	106.	(2)	151.	(3)
17.	(3)	62.	(2)	107.	(2)	152.	(4)
18.	(4)	63.	(1)	108.	(2)	153.	(2)
19.	(3)	64.	(1)	109.	(3)	154.	(3)
20.	(2)	65.	(3)	110.	(3)	155.	(2)
21.	(3)	66.	(3)	111.	(1)	156.	(1)
22.	(4)	67.	(3)	112.	(1)	157.	(3)
23.	(4)	68.	(4)	113.	(2)	158.	(1)
24.	(2)	69.	(1)	114.	(4)	159.	(2)
25.	(1)	70.	**Incorrect**	115.	(3)	160.	(1)
26.	(1)		**Question**	116.	(1)	161.	(Bonus)
27.	(1)		**(Bonus)**	117.	(1)	162.	(2)
28.	(2)	71.	(1)	118.	(3)	163.	(3)
29.	(1)	72.	(3)	119.	(3)	164.	(2)
30.	(2)	73.	(4)	120.	(4)	165.	(3)
31.	(2)	74.	(4)	121.	(4)	166.	(2)
32.	(1)	75.	(2)	122.	(4)	167.	(2)
33.	(3)	76.	(1)	123.	(3)	168.	(1)
34.	(3)	77.	(1)	124.	(3)	169.	(1 & 2)
35.	(4)	78.	(2)	125.	(4)	170.	(2)
36.	(4)	79.	(1)	126.	(2)	171.	(1)
37.	(2)	80.	(4)	127.	(2)	172.	(2)
38.	(3)	81.	(3)	128.	(1)	173.	(3)
39.	(3)	82.	(4)	129.	(2)	174.	(2)
40.	(1)	83.	(2)	130.	(2)	175.	(1)
41.	(1)	84.	(3)	131.	(4)	176.	(3)
42.	(3)	85.	(4)	132.	(2)	177.	(2)
43.	(2)	86.	(3)	133.	(3)	178.	(3)
44.	(3)	87.	(3)	134.	(4)	179.	(4)
45.	(4)	88.	(4)	135.	(1)	180.	(4)
		89.	(2)				
		90.	(3)				

HINTS & SOLUTION

BIOLOGY

1.   (4)

Sol.: Linkage increase incidence of parentals.

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.83

2.   (1)

Anthocyanins are water soluble vacuolar pigments

Hint: Chapter Photosynthesis in higher plants

Not given in NCERT

3.   (1)

Sol.: Relaxin hormone causes relaxation of pelvic ligaments during parturition were as inhibin has negative feedback effect with FSH

Chapter: Chemical co-ordination and integration

OUT of NCERT

4.   (4)

Sol.: Both are semi autonomous and have protein synthesizing machinery including ribosomes.

Hint: Chapter cell the unit of life

NCERT page no.134

5.   (1)

Sol.: Plasmids are ds-DNA molecules that are separate from a cells nucleoid in prokaryotes.

Chapter: Biotechnology Principles and Processes

Plasmid is double stranded DNA, Autonomously replicating unit, found in prokaryotes.

6.   (3)

Sol.: Reduction of photorespiration in C_4 plants enhances both yield and nitrogen efficiency.

Hint: Chapter Photosynthesis in higher plants

NCERT page no.90

7.   (3)

Hint: Chapter Photosynthesis in higher plants

Not given in NCERT

8.   (2)

Sol.: Smooth muscles are involuntary muscles present in wall of intestine.

Chapter: Structural organization in Animals

NCERT Page 101- last para, 103- 1st and 2nd para, 104- 2nd para

9.   (2)

Hint: Chapter Organisms and Population

NCERT page no.231

10. **(2)**

Sol.: Tapetum is nutritive layer of anther.

Hint: Chapter Sexual Reproduction in flowering plants

NCERT page no.22 to 24

11. **(4)**

Sol.; Eubacteria literally means true bacteria.

Hint: Chapter Biological classification

NCERT page no.19

12. **(4)**

Sol.: Avena curvature test is a bioassay for auxins.

Hint: Chapter plant growth and development, NCERT page no.247

13. **(1)**

Chapter: Evolution

Actually the wing of bat is homologous to flipper of whale. They have asked wings of birds. The most suitable answer is option 3 but it is a debatable question.

14. **(4)**

Chapter: Body fluids and Circulation

Blood flows under higher pressure in arteries than veins. So, blood pressure in Pulmonary artery will be higher than vena cava, but lower than aorta and carotid artery.

OUT of NCERT

15. **(3)**

Chapter: Human Reproduction

NCERT Page 51- 2nd para, 8th line

16. **(2)**

Sol.: Pachytene follows zygotene and is characterized by crossing over.

Hint: Chapter cell cycle cell division

NCERT page no.168

17. **(3)**

Hint: Chapter Biological classification

NCERT page no.20 and 21

18. **(4)**

Chapter: Movement and Locomotion

OUT of NCERT

19. **(3)**

Sol.: Inhibin hormone is produced by granulosa cells of follicles in ovary and inhibit the secretion of FSH

Chapter: Human Reproduction

Inhibin is secreted by corpus luteum to inhibit FSH but not LH

20. **(2)**

Sol.: In Emphysema wall separating alveoli breaks and there is decrease in overall surface area available for gas exchange.

Chapter: Breathing and Exchange of Gases

NCERT Page 275, last para

21. **(3)**

Sol.: It follows X-linked / criss – cross inheritance.

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.89

22. **(4)**

Sol.: *Sequoia* or redwood trees are among the tallest trees.

Hint: Chapter Plant kingdom

NCERT page no.38 and 39

23. **(4)**

Hint: Chapter Molecular Basis of Inheritance

NCERT page no.117

24. **(2)**

Sol.: Monohybrid mendelian cross

Hint: Chapter Principles of Inheritance

NCERT page no.73

25. **(1)**

Sol.: It is the root-knot nematode

Chapter: Biotechnology and Its applications

NCERT Page 210, 3rd para, 3rd Line

26. **(1)**

Sol.: Synapsis occurs during meiosis I between homologous chromosomes

Hint: Chapter Cell the unit of life

NCERT page no.137 and 138

27. **(1)**

Chapter: Human health and diseases

Cancer lines have large amount of telomerase. If mutation inhibits production of telomerase, the quantity of telomerase will be reduced.

OUT of NCERT

28. **(2)**

Sol.: Chitin is a polymer of N-acetylglucosamine.

Hint: Chapter Biological classification

Not given in NCERT

29. **(1)**

Sol.: It is the rudimentary cotyledon.

Hint: Chapter Morphology of Flowering plants

NCERT page no.177

30. **(2)**

Sol.: Lichens are pioneer vegetation during xerarch.

Hint: Chapter Ecosystem

NCERT page no.250

31. **(2)**

Sol.: GnRH is secreted by hypothalamus & it acts on anterior pituitary to regulate production of FSH & LH

Chapter: Human Reproduction

Inhibin inhibits FSH from pituitary but doesn't inhibit GnRH from hypothalamus.

OUT of NCERT

32. **(1)**

Sol.: Polio drops that are administered into the body contain attenuated pathogens.

Chapter: Human health and diseases

OUT of NCERT

33. **(3)**

Sol.: Photosensitive compound in human retina consist of protein opsin & retinal

Chapter: Neural control and Co-ordination

NCERT Page 324- 4th Para, 4th Line

34. **(3)**

Hint: Chapter Anatomy of flowering plants

NCERT page no.89

35. **(4)**

Sol.: Parapodia are extensions of body wall in case of annelids

Chapter: Kingdom Animalia

Parapodia is a feature of Annelids

NCERT Page 53

36. **(4)**

Sol.: affinity of hemoglobin with oxygen decreases when pH decreases.

Chapter: Breathing and Exchange of Gases

High concentration of Hydrogen ions causes dissociation curve to shift towards right favouring breakdown of oxyhaemoglobin

NCERT Page 274

37. **(2)**

Chapter: Kingdom Animalia

Exception to option 1 is Prototherians (egg laying Mammals)

Exception to option 2 is Cyclostomes (jawless vertebrate)

Exception to option 3 is Crocodile (Reptile with 4 chambered heart)

38.   **(3)**

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.75, 76, 77

39.   **(3)**

Sol.:   Triglycerides consist of one glycerol and three fatty acid molecules.

Chapter: Biomolecules

A typical fat molecule or neutral fat or true fats or triglycerides consists of one glycerol and 3 fatty acid molecules.

NCERT Page 144- 2nd para

40.   **(1)**

Hint: Chapter Sexual Reproduction flowering plants

NCERT page no.21

41.   **(1)**

Sol.:   Glycine is simplest amino acid. Sulphur containing amino acids are cysteine & methionine.

Chapter: Biomolecules

NCERT Page 145, 148

42.   **(3)**

Hint: Chapter Photosynthesis in higher plants

Not given in NCERT

43.   **(2)**

Hint: Chapter cell the unit of life, NCERT page no.129

44.   **(3)**

Hint: Chapter Ecosystem

Not given in NCERT

45.   **(4)**

Hint: Chapter Biodiversity and conservation, NCERT page no.264

46.   **(3)**

Sol.:   Due to development of proton gradient.

Hint: Chapter Photosynthesis in higher plants

NCERT page no.214

47.   **(3)**

Hint: Chapter Molecular Basis of Inheritance

Not given in NCERT

48.   **(4)**

Hint: Chapter Biological classification

NCERT page no.19

49. **(3)**

Sol.: *Periplaneta americana* as spiral cleavage during embryonic development.

Chapter: Structural organization in Animals

N- acetyl glucosamine is chitin which forms exoskeleton in cockroach. Arthropods are metamerically segmented. Schizocoel is found in Annelids, Arthropods, and Molluscs. Cockroach shows indeterminate and spiral cleavage (also seen in Annelids and Molluscs)

OUT of NCERT

50. **(2)**

Sol.: It is a system of rotating crops with legumes / grass pastures to improve soil structure and fertility.

Hint: Chapter Strategies for Enhancement in Food Production

Not given in NCERT

51. **(1)**

Hint: Chapter Microbes in human welfare, Not given in NCERT

52. **(4)**

Sol.: Urea is synthezied in liver from ammonia and carbon dioxide.

Chapter: Elimination of Nitrogenous waste

OUT of NCERT

53. **(1)**

Sol.: It is an autosomal recessive disorder.

Hint: Chapter Principles of Inheritance and variation

NCERT page no.89 and 90

54. **(1)**

Sol.: Sphincter of Oddi guards the opening of hepatopancretic duct into the duodenum.

Chapter: Digestion and Absorption

NCERT Page 261, 2nd para, 3rd line

55. **(3)**

Hint: Chapter Cell the unit of life

NCERT page no.137 and 138

56. **(1)**

Hint: Sexual reproduction in flowering plant

NCERT page no.35

57. **(2)**

Hint: Chapter Morphology of Flowering Plants

NCERT page no. 81

58. **(2)**

Hint: Chapter Morphology of flowering plants

Not given in NCERT

59. **(2)**

Sol.: It is a thermostable enzyme.

Chapter: Biotechnology Principles and Processes

NCERT Page 203, 1st para, 8th Line

60. **(4)**

Sol.: Seen in Cactus, Opuntia etc.

Hint: Chapter Morphology of Flowering plants

Not given in NCERT

61. **(4)**

Chapter: Human health and diseases

NCERT Page 153, 3rd para- 5th Line

62. **(2)**

Sol.: It is written in Latin.

Hint: Chapter living world

NCERT page no.7

63. **(1)**

Sol.: The male gametes are motile / flagellated.

Hint: Chapter Plant Kingdom

NCERT page no.35 and 36

64. **(1)**

Sol.: Amniocentesis is not used for detection of cleft palate.

Chapter: Reproductive health

Cleft palate is a structural deformity which can be detected only on ultrasound.

OUT of NCERT

65. **(3)**

Sol.: Parietal or oxyntic cells present in gastric glands of stomach secrete HCl.

Chapter: Digestion and Absorption

NCERT Page 262, 2nd para, 3rd line

66. **(3)**

Hint: Chapter Cell cycle cell division

NCERT page no.165

67. **(3)**

Hint: Not given in NCERT

68. **(4)**

Hint: Chapter Cell the unit of life

NCERT page no. 134

69.   **(1)**

Hint: Chapter Biotechnology and its application

NCERT page no.211 Para 1, diagram 12.3

Insulin is a simple protein showing 3 chains A B and C connected by Disulphide bridges

70.   Incorrect Question (Bonus)

71.   **(1)**

Sol.:   RNA is of low molecular weight.

Hint: Chapter Biological classification

NCERT page no.27

72.   **(3)**

Chapter: Evolution

NCERT Page 131, 1st para, 3rd line

73.   **(4)**

Sol.:   Level of LH and FSH increases gradually during the follicular phase.

Chapter: Human Reproduction

LH and FSH gradually increases during follicular phase.

NCERT Page 50, figure 3.9

74.   **(4)**

Chapter: Kingdom Animalia

Birds are strictly oviparous

75.   **(2)**

Hint: Chapter Sexual Reproduction in Flowering Plants

NCERT page no.31

76.   **(1)**

Hint: Chapter Sexual Reproduction in flowering plants

NCERT page no.38

77.   **(1)**

Sol.:   Sperm production continues after vasectomy

Chapter: Reproductive health

Vasectomy doesn't prevent spermatogenesis as it occurs in Testis.

NCERT Page 60, 5th Last line, 2nd para 1st line, Page 61- 2nd Para, 9th- 11th Line

78.   **(2)**

Chapter: Chemical Control and Co-ordination

T3, T4 are derivatives of tyrosine. Estrogen, Progesterone, Cortisol and Cortisone are steroids.

OUT of NCERT

79.   **(1)**

Hint: Chapter Environmental Issues

NCERT page no.275

80. **(4)**

Hint: Chapter Organisms and Population; NCERT page no.235

81. **(3)**

Chapter: Human Health and diseases

Mast cells are histaminic causing inflammation during asthma

NCERT Page 123, 2nd para

82. **(4)**

Hint: Chapter Morphology of Flowering plants

NCERT page no.74

83. **(2)**

Chapter: Biotechnology Principles and Process

NCERT Page 195, 5th para, 6th Line

84. **(3)**

Chapter: Organisms and Population; OUT of NCERT

85. **(4)**

Chapter: Evolution ; OUT of NCERT

86. **(3)**

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.90

87. **(3)**

Hint: Chapter Environmental Issues

NCERT page no.282

88. **(4)**

Hint: Chapter Environmental Issues

NCERT page no.285

89. **(2)**

Hint: Chapter Molecular Basis of Inheritance

NCERT page no.115

90. **(3)**

Hint: Chapter Ecosystem

Not given in NCERT

PHYSICS

91. **(1)**

Use C. of energy and centrifugal force at top most point.

92. **(3)**
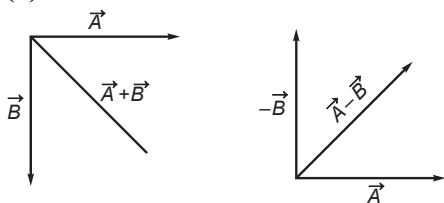
93. **(2)**

$-\dfrac{GM}{r} = -5.4 \times 10^7$ \qquad ...(i)

$+\dfrac{GM}{r} = 6$ \qquad ...(ii)

(i) ÷ (ii)

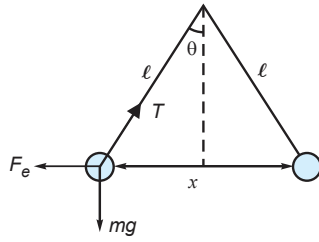$\dfrac{\dfrac{GM}{r}}{\dfrac{GM}{r^2}} = r \cdot \dfrac{5.4 \times 10^6}{6}$

$r = 9 \times 10^3$ km

94. **(1)**

Total flux = n flux of each long

$= 1000 \times 4 \times 10^{-3} = Li$

$L = \dfrac{10^3 \times 4 \times 10^{-3}}{4} = 1$

95. **(2)**

96. **(4)**

$$\left. \begin{array}{l} T\sin\theta = \dfrac{kq^2}{x^2} \\[2mm] T\cos\theta = mg \end{array} \right\} \quad \begin{array}{l} \tan\theta = \dfrac{kq^2}{mgx^2} = \\[2mm] \sin\theta = \dfrac{kq^2}{mgx^2} = \dfrac{x}{2l} \end{array}$$

$$\Rightarrow \quad q^2 = \dfrac{x^3 mg}{x\,2l}$$

$$q = \left(\dfrac{mg}{k\,2l}\right)^{\frac{1}{2}} x^{\frac{3}{2}}$$

$$\dfrac{dq}{dt} = \left(\dfrac{mg}{2 \times l}\right)^{\frac{1}{2}} \dfrac{3}{2} x^{\frac{1}{2}} \dfrac{dx}{dt}$$

$\Rightarrow x^{1/2}$ v = constant

v $\propto x^{-1/2}$

97.   (1)

Include energy = $\dfrac{1}{2} \times 2 \times v^2$

Energy loss

$$\dfrac{1}{2} \times \left(\dfrac{2 \times 8}{2+8}\right) \times (v.0)^2$$

$$\dfrac{1}{2} \times \left(\dfrac{16}{10}\right) \times v^2$$

% loss = $\dfrac{\dfrac{1}{2} \times \dfrac{16}{10} \times v^2}{\dfrac{1}{2} \times 2 \times v^2} \times 100 = \dfrac{1800}{2}$

98.   (4)
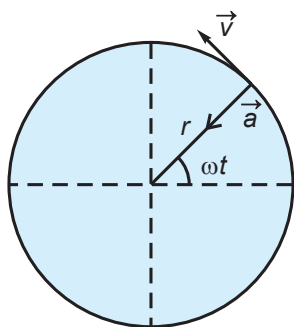
Particle is performing a circular motion.

99. **(3)**

$I = I_0 - I_1$

$= \dfrac{MR^2}{2} - \left(\dfrac{M}{4} \dfrac{(R/2)^2}{2} + \dfrac{M}{4} \left(\dfrac{R}{2} \right)^2 \right)$

$= MR^2 \left[\dfrac{1}{2} - \dfrac{1}{32} - \dfrac{1}{16} \right]$

$= \dfrac{13MR^2}{32}$

100. **(3)**

$V_e = \sqrt{2gR}$

$= \sqrt{\dfrac{2GM}{R^2} R}$

$V_e = \sqrt{\dfrac{2GM}{\frac{4\pi}{3} R^2} R^2 \dfrac{4\pi}{3}}$

$V_e = \sqrt{2 \left(\dfrac{4}{3} \right) \pi \times \rho R^2}$

$\dfrac{V_{e_2}}{V_{e_1}} = \sqrt{\left(\dfrac{\rho_2}{\rho_1} \right) \left(\dfrac{R_2}{R_1} \right)^2} = \sqrt{2 \times 2^2} = 2\sqrt{2}$

101. **(1)**

$\dfrac{\varepsilon_1 + \varepsilon_2}{\varepsilon_1 - \varepsilon_2} = \dfrac{5}{1}$ $\varepsilon_1 + \varepsilon_2 = 5\varepsilon_1 - 5\varepsilon_2$

$6\varepsilon_2 = 4\varepsilon_1$

$\dfrac{\varepsilon_1}{\varepsilon_2} = \dfrac{3}{2}$

102. **(4)**

$$f = f_0 \left(\frac{V + V_0}{V - V_s} \right)$$

$$800 \left(\frac{330 + 0}{330 - 15} \right)$$

$$\frac{330}{315} \times 800$$

$$\frac{330}{315} \times 800 \left(\frac{330}{330} \right) = 838 \text{Hz}$$

103.   (1)

Using properties of OR and AND Gate

104.   (1)

$\sin \theta = \dfrac{\lambda}{a}$ Position of first minima

$\sin 30° = \dfrac{5000}{a}$ \qquad a = 10,000 A°

$\sin \theta = \dfrac{3\lambda}{2a} = \dfrac{3 \times 5000}{2 \times 10,000}$

$\theta = \sin^{-1} \dfrac{3}{4}$ position of first secondary maxima.

105.   (1)

$$\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + ev \qquad\qquad ......(1)$$

$$\frac{hc}{2\lambda} = \frac{hc}{\lambda_0} + e\frac{v}{4} \qquad\qquad ....(2)$$

$$\frac{hc}{2\lambda} = \frac{3ev}{4}$$

$$ev = \frac{2hc}{3\lambda}$$

$$\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + \frac{2hc}{3\lambda}$$

$$\frac{hc}{\lambda_0} = \frac{hc}{3\lambda}$$

$$\lambda_0 = 3\lambda$$

106.   (2)

$$\frac{1}{2}mv^2 = \frac{kze^2}{r} \qquad\qquad r \propto \frac{1}{m}$$

107.   (2)

(A) → b, c; \qquad\qquad (B) → b, c \qquad\qquad (C) → b, d \qquad\qquad (D) → a, d

108.   (2)

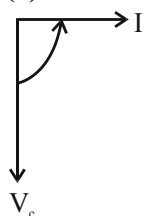$$\frac{1}{2} \times 10 \times 10^{-3} \times v^2 = 8 \times 10^{-4}$$

$$V^2 = 16 \times 10^{-2}$$

$$V = 4 \times 10^{-1} = 0.4 \, m/s$$

$$0.4 \times 0.4 = 0 + 2 \times a \times 4\pi \times \frac{6.4}{100}$$

$$a = 0.1 \, m/s^2$$

109. **(3)**

$\text{Cos}\phi = 0$ so it will not consume energy

110. **(3)**

$$a_c = \frac{F}{M}\left[\frac{1 + {r}/{R}}{1 + {I_c}/{MR^2}}\right] = g\sin\theta\left[\frac{1}{1 + \frac{I_c}{MR^2}}\right]$$

Since sphere has less moment of inertia

So it reaches bottom first

111. **(1)**

$$l_1' = l_1\left(1 + \alpha_1 \Delta T\right)$$

$$l_2' = l_2\left(1 + \alpha_2 \Delta T\right)$$

$$l_1' = l_1 + l_1\alpha_1 \Delta T$$

$$l_2' = l_2 + l_2\alpha_2 \Delta T$$

$$l_1' - l_2' = l_1 - l_2 + \left(l_1\alpha_1 - l_2\alpha_2\right)\Delta T$$

$$l_1\alpha_1 = l_2\alpha_2$$

112. **(1)**

$$\frac{1}{V} - \frac{1}{-200} = \frac{1}{40}$$

$$\frac{1}{V} = \frac{1}{40} - \frac{1}{200} = \frac{5-1}{200} = \frac{4}{200} = \frac{1}{50}$$

$$V = 50 \, cm$$

$$50 + 4 = 54 \, cm$$

113. **(2)**

$\omega_f = \omega_i + \alpha t$
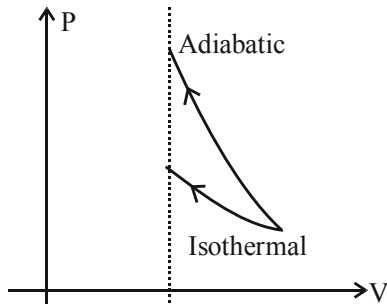
$= 0 + 2 \times 2 = 4$

$$a_c = \omega^2 r = 4^2 \times \frac{1}{2} = 8$$

114. **(4)**

$$COP = \frac{T_2}{T_1 - T_2} = \frac{\text{Heat extracted}}{\text{input work}}$$
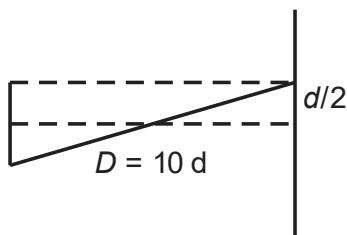
115. **(3)**

116. **(1)**

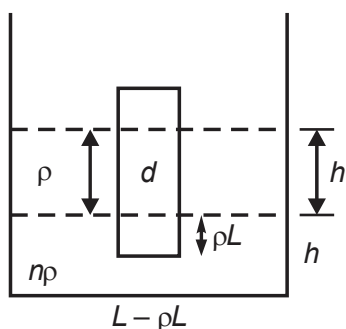Let intensity due to one slit is I

$$I_0 = 4I$$

$$I = \frac{I_0}{4}$$

$$\text{Phase diff.} = \frac{2\pi}{\lambda} \cdot \frac{d}{D} \cdot \frac{d}{2} = \frac{2\pi}{\lambda} \frac{d}{10d} \cdot \frac{d}{2} d$$

$$\phi = \frac{2\pi}{\lambda} \cdot \frac{2\lambda}{10 \cdot 2} = \frac{\pi}{2}$$

$$I' = 4I \cos^2 \frac{\phi}{2}$$

$$= 4 \cdot \frac{I_0}{4} \cdot \frac{1}{2} = \frac{I_0}{2}$$

117. **(1)**

$ALdg = ApL\,n\rho g + Ah.\rho g$

$Ld = pL\,n\rho + h\rho$

$= pLn\rho + \rho.L(1 - p)$

$d = L\rho\,(np + 1 - p)$

118.   (3)

$i = \dfrac{V}{R} = \dfrac{4 - (-6)}{1\,k\Omega} = \dfrac{10V}{1000\Omega} = 10^{-2}\,A$

119.   (3)

$$v = \sqrt{gR\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$$

120.   (4)

121.   (4)

$$\dfrac{h_c}{\lambda} = \left[\left(\dfrac{R}{h_c}\right)\left[\dfrac{1}{4} - \dfrac{1}{\infty}\right]\right]$$

$$\dfrac{1}{\lambda} = \dfrac{R}{4} = \dfrac{10^7}{4}$$

Wave number $= \dfrac{1}{\lambda}.\,0.25 \times 10^7$

122.   (4)

$V = At + Bt^2$

$= 0.t(A + Bt)$

$t = -\dfrac{A}{B}$

$\dfrac{dx}{dt} = At + Bt^2$

$dx = \dfrac{At^2}{2} + \dfrac{Bt^3}{3}\bigg|_0^1$
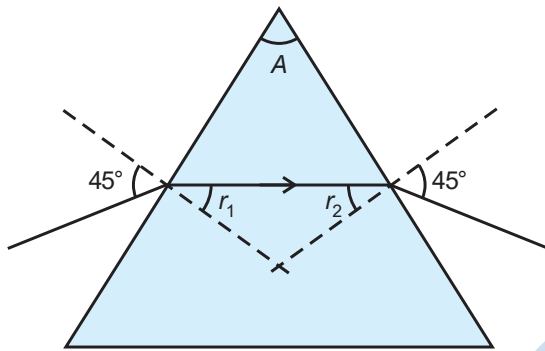
$$\frac{A}{2} + \frac{B}{3}$$

$$\frac{A \times 2t}{2} + \frac{B \times 2^3}{3}$$

$$2A + \frac{B8}{3}$$

$$2A - \frac{A}{2} + \frac{8B}{3} - \frac{B}{3}$$

$$\frac{3}{2}A + \frac{7B}{3}$$

123.   **(3)**

$$\mu = \delta + A = i_1 + e$$

$$\delta + 60° = 90°$$

$$\delta = 30°$$

$$G = \frac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)} = \frac{\sin 45°}{\sin 30°} = \frac{1/\sqrt{2}}{1/2} = \sqrt{2}$$

124.   **(3)**
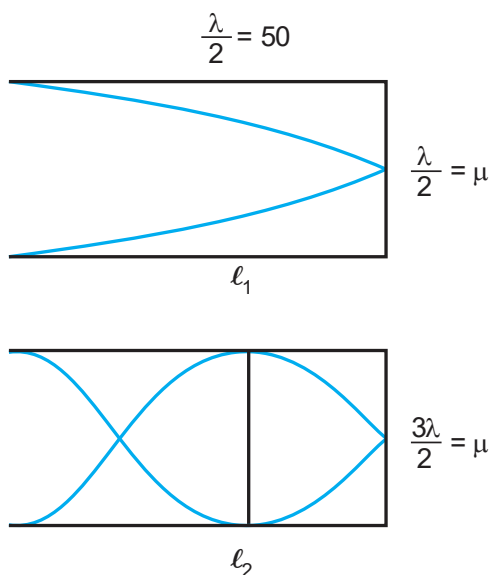
$$v_{rms} \propto \sqrt{T}$$

$$\frac{v}{200} = \sqrt{\frac{400}{300}}$$

$$v = \frac{200 \times 2}{\sqrt{3}} = \frac{400}{\sqrt{3}}$$

125.   **(4)**

$$\frac{\lambda}{2} = 50$$

$$\frac{\lambda}{2} = \mu$$

$$\frac{3\lambda}{2} = \mu$$

$$(2\lambda + 1)\frac{\lambda}{2} = \ell$$

$$\lambda = \frac{\mu}{2n+1} \quad f = c$$

$$f = \frac{(2n+1)}{2\ell}$$

$$\ell = \frac{(26+1)c}{2f}$$

$N = 0$

and $N = 1$

126. **(2)**

Theory

127. **(2)**

$$\lambda_e = \frac{h}{\sqrt{2mE}}$$

$$\lambda_p = \frac{hc}{E}$$

$$\frac{\lambda_e}{\lambda_p} = c\left(\frac{E}{2m}\right)^{1/2}$$

128. **(1)**

$$P = \vec{F}.\vec{v}$$
$$= \left(2t\hat{i} + 2t^2\hat{j}\right)N$$
$$= 2t^3\hat{i} + 3t^5\hat{j}$$
$$\vec{a} = \left(2t\hat{i} + 3t^2\hat{j}\right)\text{ m/s}^2$$
$$\vec{v} = t^2\hat{i} + t^3\hat{j}$$

129. **(2)**

$$Q = 0 \Rightarrow t^{20}, t = \frac{a}{2B}$$

$$dH = i^2 R dt$$

$$i = \frac{ds}{dt} = a - 2b - f$$

$$H = \int dH \int_{0}^{2b} \left(a - 2bt\right)^2 R dt$$

$$= \left[\frac{\left(a - 2bt\right)^3}{-6b}\right]_{0}^{b/2}$$

$$= \frac{-1}{6b}\left[0 - a^3\right]R$$

$$= \frac{a^3 R}{6b}$$

130. **(2)**

$$v_{\text{gain}} = \beta \frac{R_L}{R_{BE}}$$
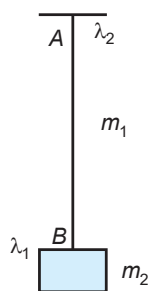
$$\text{Power gain} = \beta^2 \frac{R_L}{R_{BE}}$$

131. **(4)**

$$\frac{1}{2} \times mgh = mL$$

132. **(2)**

$$F = F_{AB} - F_{LD}$$

$$= \frac{\mu_0 I}{2\pi \frac{L}{2}} iL + \frac{\mu_0 I}{2\pi \frac{3L}{2}} iL$$

$$= \frac{\mu_0 Ii}{2\pi}\left(2 - \frac{2}{3}\right)$$

$$= \frac{2\mu_0 Ii}{3\pi}$$

133. **(3)**

$$\frac{\lambda_2}{\lambda_1}$$

$$v \propto \sqrt{T}$$

$$\frac{v_A}{v_B} = \sqrt{\frac{m_2}{m_2 + m_1} \cdot \frac{m_1 + m_2}{m_2}}$$

134. **(4)**

$$\lambda_m T = b$$

and $U \propto T^4$

$$T_1 > T_2 > T_3$$
$$U_1 > U_2 > U_3$$

135. **(1)**

Theory

CHEMISTRY

136. **(3)**

Sol. The physical and chemical adsorption is accompanied with decrease in FREE ENERGY, ENTHALPY and ENTROPY.

137. **(2)**

Sol. Hydrogen ion concentration in pure water at 298 K = 10^{-7}m. Reduction potential of hydrogen electrode is given by.

$$E_{H^+/H_2} = -\frac{0.0591}{2} \log \frac{P_{H_2}}{\left[H^+\right]^2}$$

$$E_{H^+/H_2} = 0 \text{ if } P_{H_2} = \left[H^+\right]^2 = 10^{-14} \text{ atm}$$
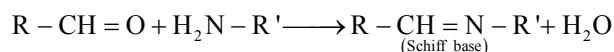
138. **(1)**

Sol. The addition of a catalyst during a chemical reaction alters the activation energy.

139. **(3)**

Sol. Reactions (a), (b) and (c) are elimination, substitution and addition respectively.

140. **(2)**

Sol. Aldehyde reacts with a primary amine to form schiff base

$$R - CH = O + H_2N - R' \longrightarrow \underset{(\text{Schiff base})}{R - CH = N - R'} + H_2O$$

141. **(2)**

Sol. Arylamines are less basic than alkylamines because the lone pair of electrons on N-atom is involved in resonance with the benzene ring.

142. **(2)**

Sol. Let the initial moles of each of H_2 and O_2 be 1. Number of moles of H_2 diffused in certain time = 0.5. Number of moles of O_2 diffused (say x) in the same time is given by $\dfrac{r_{O_2}}{r_{H_2}} = \dfrac{x}{0.5} = \sqrt{\dfrac{2}{32}} = \dfrac{1}{4} \Rightarrow x = \dfrac{1}{8}$

143. **(1)**

Sol. The staggered conformation of ethane is more stable than eclipsed conformation because staggered conformation has no torsional strain.

144. **(3 & 4)**

Sol. The correct order of first ionisation enthalpy is B < C < O < N

The correct order of electron gain enthalpy is I < Br < F < Cl

145. **(2)**

Sol. Rate of a first order reaction at 10 min and 20 min is given by

$R_{10} = k[A]_{10} = 0.04$ mol L^{-1} s^{-1}

$R_{20} = k[A]_{20} = 0.03$ mol $L^{-1}s^{-1}$

$\dfrac{[A]_{10}}{[A]_{20}} = \dfrac{4}{3} = e^{(20-10)k} = e^{10k}$

On solving, $k = \dfrac{2.303 \times 0.125}{10} s^{-1}$

Half life, $f_{1/2} = \dfrac{0.693 \times 10}{2.303 \times 0.125} = 24.1s$

146. **(2)**

Sol. Copper reacts with conc. HNO_3 to give $Cu(NO_3)_2$ and NO_2

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

147. **(4)**

Sol. In a protein molecule various amino acids are linked together by peptide bond.

148. **(2)**

Sol. Fog is a colloid of liquid dispersed in gas.

149. **(2)**

Sol. (a) cyanide process is applicable for Au

(b) Froth floatation process is applicable for sulphide ores like ZnS.

(c) Electrolytic reduction is done for 'Al'

(d) Zone refining process is used for the extraction of ultrapure metals like Ge, Si, etc.

150. **(1)**

Sol. Sucrose is a non reducing sugar.

151. **(3)**

Sol. The sugar in RNA is ribose and the sugar in DNA is 2'-deoxyribose.

152. **(4)**

Sol. $\Delta G = \Delta H - T\Delta S$

For a spontaneous process, $\Delta G = -ve$. So, $\Delta H < 0$ and $\Delta S > 0$

153. **(2)**

Sol. Phosphinic acid (H_3PO_2) is monoprotic acid and phosphonic acid (H_3PO_3) is diprotic acid.

154. **(3)**

Sol. If s and s' are the solubilities of MY and NY_3 respectively, then

$s = \sqrt{6.2 \times 10^{-13}} = 7.87 \times 10^{-7}\,M$

$s' = \left(\dfrac{6.2 \times 10^{-13}}{27}\right)^{1/4} = 3.89 \times 10^{-4}\,M$

155. **(2)**

Sol. Novalgin is analgesic, rest are antibiotics.

156. **(1)**

Sol.

$$CH_3 - C \equiv \overset{\ominus}{C} \textcircled{1}$$

Hybridization sp

The lone pair is present in 'sp' hybridized orbital of 'C'.

157. **(3)**

Sol. Stability of conjugate base :

$ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

158. **(1)**

Sol. $K_2Cr_2O_7 + H_2SO_4 + 3SO_2 \longrightarrow \underset{(green)}{Cr_2(SO_4)_3} + K_2SO_4 + H_2O$

159. **(2)**

Sol. According to VSEPR theory : lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

160. **(1)**

Sol. $m_s = \pm\dfrac{1}{2}$ for 2 electrons having rest same quantum numbers.

According to Pauli's exclusion principle, no two electrons of same spin can occupy the same orbital.

161. (Bonus)

Sol. $CaC_2 + N_2 \longrightarrow CaCN_2 + C$

162. **(2)**

Sol. Natural rubber is polymer of Cis-isoprene units.

163. **(3)**

Sol. Bond dissociation energy

$$Cl_2 > Br_2 > F_2 > I_2$$

B.E(kJ / mol) 242.6   192.8   158.8   151.1

164. **(2)**

Sol. $ROH \xrightarrow{\text{NaH}} RO^- \xrightarrow{R'-X} R-O-R'$

The given reaction is Williamson ether synthesis.

165. **(3)**

Sol. $d = \dfrac{Z \times M}{a^3 \times N_A}$

$a^3 = \dfrac{2 \times 6.94}{530 \times 10^{-3} \times 6.02 \times 10^{23}} = \dfrac{13.88}{530 \times 10^{-3} \times 6.02 \times 10^{23}}$

$a = 352\,pm$

166. **(2)**

Sol. $\dfrac{r^+}{r^-} = 0.54 \Rightarrow C.N = 6$

167. **(2)**

Sol. $\dfrac{P^o - P_s}{P_s} = \dfrac{n_{solute}}{n_{solvent}} = \dfrac{6.5/M}{100/18}$

$\dfrac{760 - 732}{732} = \dfrac{6.5 \times 18}{100 \times M}$

$M = \dfrac{6.5 \times 18 \times 732}{28 \times 100} = 30.58$

$\Delta T_b = K_b.m = 0.52 \times \dfrac{\frac{6.5}{30.58}}{0.1} = 1.1^o C$

$T_b = 101.1^o C$
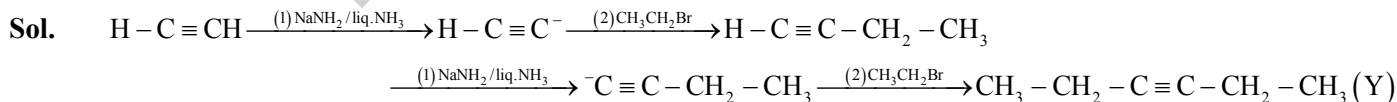
168. **(1)**

Sol. Stability of half filled 'f'sub-shell.

169. (1 & 2)

170. **(2)**

Sol. $H-C\equiv CH \xrightarrow{(1)\,NaNH_2/liq.NH_3} H-C\equiv C^- \xrightarrow{(2)CH_3CH_2Br} H-C\equiv C-CH_2-CH_3$

$\xrightarrow{(1)\,NaNH_2/liq.NH_3} {}^-C\equiv C-CH_2-CH_3 \xrightarrow{(2)CH_3CH_2Br} CH_3-CH_2-C\equiv C-CH_2-CH_3\,(Y)$

171. **(1)**

Sol. $\dfrac{d\ln P}{dT} = \dfrac{\Delta H_v}{RT^2}$ [Clausius – Clapeyron equation]

172. **(2)**

Sol. $y_B = \dfrac{p_B}{p_T} = \dfrac{p_B^0 X_B}{p_A^0 X_A + p_B^0 X_B}$

$y_{Benzene} = \dfrac{12.8 \times \dfrac{1}{2}}{\dfrac{1}{2}\left(12.8 + 3.85\right)}$
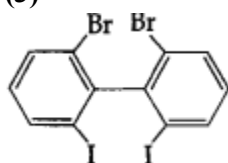
$y_{Benzene} = 0.77$

$y_{toluene} = 0.23$

$\therefore y_{Benzene} > y_{Toluene}$
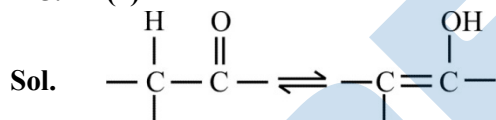
173. **(3)**

Sol.

It has no plane of sym and centre of sym.

174. **(2)**

Sol. Cis-cyclopenta-1, 2 diol forms a ring like structure called isopropylidene derivative with acetone in acidic medium, while trans-cyclopenta-1, 2 diol can't form ring like structure.

175. **(1)**

Sol.
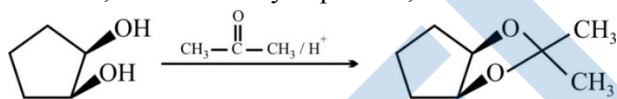
Carbonyl compounds with α-hydrogen atom readily equilibrates into its enol form due to acidic nature of α-hydrogen atom. This is known as keto-enol tautomerism.

176. **(3)**

Sol.

Molecule	CH_4	NH_3	H_2O
Bond angle	109.5°	107°	104.5°

177. **(2)**

Sol. (a) XeF_6 : H = sp^3d^3; 6B.P + 1 L.P – distorted octahedral

(b) XeO_3 : H = sp^3 ; 3B.P + 1 LP – Pyramidal

(c) $XeOF_4$: H = sp^3d^2 ; 5B.P + 1 LP – square pyramidal

(d) XeF_4 : H = sp^3d^2 : 4B.P + 2LP – square planar

178. **(3)**

Sol.   Addition of large amount of KHSO$_4$ to the nitrating mixture reduces the rate of nitration by lowering the conc. of NO$_2^+$ ion.

179.   (4)

Sol.   Ca^{2+} ions are important in maintaining the regular heart beat.

180.   (4)

Sol.   Since Fe in [Fe(CO$_4$]$^{2-}$ has 2 –ve charges, its tendency to use its filled orbital to overlap with the vacant anti-bonding MO of CO is high, so C — O bond length in this complex is the longest.