IMPORTANT INSTRUCTIONS :

- **Pattern of the Entrance Examination**:-
  Paper containing 180 objective type questions ,from Biology, Physics and Chemistry
- **Use Blue/Black Ball Point Pen only** to darken the appropriate circle. Answers marked with pencil would not be evaluated.
- Each item carries **4marks**. For each correct response the candidate will get 4 marks. For each incorrect response **1mark** will be deducted from the total score

01. NBRI is located in
  (1) New Delhi
  (2) Lucknow
  (3) Kolkata
  (4) Simla

02. How many of the following are found in *Euglena* ?
  70s Ribosomes ; cell wall ; plastids ;
  80s Ribosomes ; mitochondria
  (1) 5
  (2) 3
  (3) 2
  (4) 4

03. Identify the following

  (1) *Rhizopus*
  (2) *Mucor*
  (3) *Aspergillus*
  (4) *Trichoderma*

04. Statement-I : Conducting tissues are absent in the gametophytes of spermatophytes.
  Statement-II : Archegoniatae includes Bryophyta, Pteriodophyta and Gymnosperms.
  (1) Both Statement I and Statement II are correct
  (2) Statement I is correct, Statement II is wrong
  (3) Statement I is wrong, Statement II is correct
  (4) Both Statement I and Statement II are wrong

05. Identify the mismatch
  (1) *Alstonia* – Whorled phyllotaxy
  (2) Banana - Sucker
  (3) Jasmine - Stolon
  (4) Pineapple – Rhizome

06. The United Nations Climate Change Conference (Conference of the Parties, COP) in the year 2019 was held at:
  (1) Glasgow, UK
  (2) Madrid, Spain
  (3) Geneva, Switzerland
  (4) Kyoto, Japan

07. The government of India has initiated stringent norms for automobile fuels for the reduction in _____ and _____ in petrol and diesel:
(1) Sulphur; aromatic content
(2) CO_2; phosphine
(3) Lead; CH_4
(4) Aromatic content; CO_2

08. Mass of living matter at a trophic level in an area at any time is called
(1) Standing state
(2) Standing crop
(3) Detritus
(4) Humus

09. Identify the correct type of food chain:
rotting vegetable matter → dung fly → common frog → snake
(1) Decomposer food chain
(2) Detritus food chain
(3) Grazing food chain
(4) Predator food chain

10. The extinction of the passenger pigeon was mostly due to:
(1) Increased number of predatory birds
(2) Over exploitation by humans
(3) Non-availability of food
(4) Bird flu virus infection

11. Polyadelphous stamens are found in
(1) *Citrus*
(2) *Pisum*
(3) *Hibiscus*
(4) *Helianthus*

12. Identify the incorrect statement
(1) Radial vascular bundles are closed
(2) Conjoint collateral vascular bundles are either open or closed
(3) Vascular bundles are closed in dicot stems
(4) Xylem and phloem are arranged in alternate manner on different radii in radial vascular bundles

13. Complete secondary lateral meristem is
(1) Cork cambium in Dicot stem
(2) Vascular cambium in Dicot root
(3) Cork cambium in Dicot root
(4) All the above

14. The following is not related to SER
(1) Protein synthesis
(2) Lipid synthesis
(3) Synthesis of steroidal hormones in a cells
(4) Transport of substances

15. Pigments are completely absent in
(1) Amyloplasts
(2) Elaioplasts
(3) Aleuroplasts
(4) All the above

16. Which of the following is not used for construction of ecological pyramids?
(1) Fresh weight
(2) Dry weight
(3) Number of individuals
(4) Rate of energy flow

17. Two opposing forces operate in growth and development of every population. One of them is the ability to reproduce at a given rate. The opposing force is:
(1) Morbidity
(2) Fecundity
(3) Biotic potential
(4) Environmental resistance

18. Measuring Biochemical Oxygen Demand (BOD) is a method used for

(1) Measuring the activity of *Saccharomyces cerevisiae* in producing curd on a commercial scale

(2) Working out the efficiency of R.B.Cs. about their capacity to carry oxygen

(3) Estimating the amount of organic matter in sewage water

(4) Working out the efficiency of oil driven automobile engines

19. Arrange the steps of ADA – deficiency treatment in sequence:

I. The lymphocytes with ADA cDNA are returned to the patient

II. The lymphocytes from the blood of the patient are grown in culture outside the body

III. A functional ADA cDNA (using retroviral vector) is introduced into the lymphocytes

(1) $II \rightarrow III \rightarrow I$

(2) $I \rightarrow II \rightarrow III$

(3) $II \rightarrow I \rightarrow III$

(4) $III \rightarrow II \rightarrow I$

20. Outbreeding is an important strategy of animal husbandry because it:

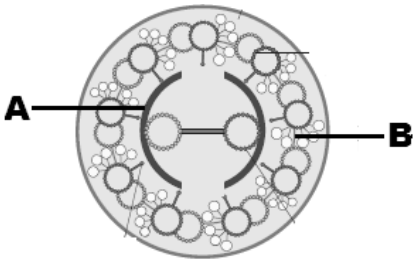
(1) is useful in overcoming inbreeding depression

(2) is useful in producing pure-lines of animals

(3) helps is accumulation of superior genes

(4) exposes harmful recessive genes that are eliminated by selection

21. Identify A and B respectively



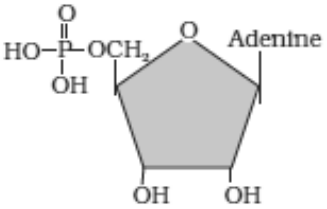
(1) Central sheath, Inter doublet bridge

(2) Central microtubule, radial spoke

(3) Radial spoke, Central microtubule

(4) Central sheath, Radial spoke

22. Identify the following structure



(1) Adenosine

(2) Deoxy adenylic acid

(3) Adenylic acid

(4) ADP

23. Identify the correct match

List-I	List-II
A) Curcumin	I) Glucose transporter
B) Concanavalin A	II) Drug
C) Glut – 4	III) Toxin
D) Ricin	IV) Lectin

	A	B	C	D
(1)	II	IV	III	I
(2)	IV	I	III	II
(3)	II	IV	I	III
(4)	IV	I	II	III

24.

$$\begin{array}{cc} X & Y \\ | & | \end{array}$$
$$C - C \rightarrow X - Y + C = C$$

The enzyme which catalyse the above reaction belongs to the following class

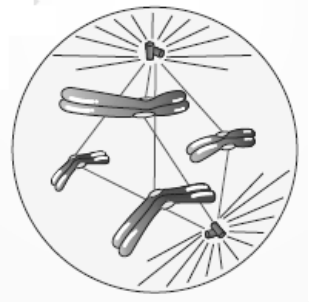
(1) Lyases

(2) Hydrolases

(3) Transferases

(4) Ligases

25. Identify the following stage



(1) Metaphase

(2) Metaphase I

(3) Anaphase

(4) Transition to metaphase

26. HIV targets include all of the following except:

(1) Helper T – cells

(2) Macrophages

(3) Cells bearing CD4

(4) Cytotoxic T- cells

27. The prevalence of dark-coloured moths in industrially polluted areas where they are better camouflaged than the paler forms (industrial melanism) is an example of :

(1) Disruptive selection

(2) Stabilising selection

(3) Directional selection

(4) Balanced polymorphism

28. Example of a homologous organ / structure are

(1) The arm of a human, wing of a bird

(2) Wing of an insect, wing of a bird

(3) Leg of a dog, leg of a spider

(4) Potato and radish

29. Choose the incorrect match *w.r.t.* HGP:

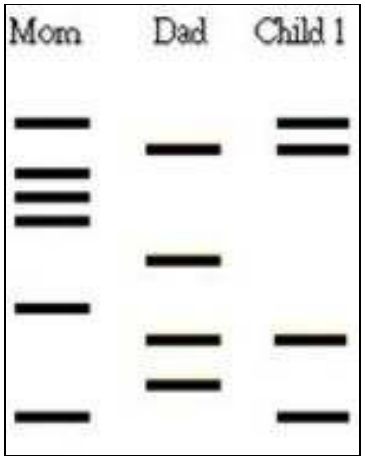
(1) 'Expressed Sequence Tags' → used to identify gene transcripts (m-RNA), and are instrumental in gene discovery

(2) 'Sequence Annotation' → sequencing both coding and non-coding sequences then marking specific regions with descriptive information about structure or function.

(3) YAC and BAC → Cloning vectors

(4) Human X chromosome → The last chromosome to be sequenced

30. What is the relationship between the child-1 and parents?



(1) Biological to only mom

(2) Biological to only dad

(3) Biological to both

(4) Biological to neither

31. Identify the correct statement
    (1) Diakinesis represents transition to Metaphase-I
    (2) Terminalization occurs in diplotene
    (3) Synapsis occurs in pachytene
    (4) Seggregation chromosomes occur in Anaphase-II
32. The following is incorrect regarding pure water in a beaker at atmospheric pressure.
    (1) $\Psi_w = O$
    (2) $\Psi_S =$ Less than O
    (3) $\Psi\pi = O$
    (4) $\Psi p = O$
33. Essential element needed for the formation of mitotic spindle is
    (1) Calcium
    (2) Sulphur
    (3) Iron
    (4) Potassium
34. Proteins can enter the respiratory pathway in the form of
    (1) Pyruvate
    (2) Acetyl CoA
    (3) Some stage within the Kreb's cycle
    (4) All the above
35. Formation of secondary cortex during secondary growth is example for
    (1) Dedifferentiation
    (2) Redifferentiation
    (3) Differentiation
    (4) Plasticity
36. A widely accepted method of contraception in India is
    (1) IUDs
    (2) Diaphragms
    (3) Tubectomy
    (4) Cervical caps
37. Correct statement *w.r.t.* Medical termination of pregnancy is:
    (1) MTP is essential in certain cases where continuation of the pregnancy could be fatal either to the mother or to the foetus or both
    (2) MTP is most unsafe during the first trimester of pregnancy
    (3) MTP is quite safe even if performed in the third trimester, provided it is performed by a trained obstetrician
    (4) MTP Act (1971) bans every type of terminations of pregnancy in India.
38. Which of the following produces the male sex hormone?
    (1) Rete testis
    (2) Seminiferous tubule
    (3) Leydig cell
    (4) Scrotum
39. If the menstrual cycle is of 32 days, then ovulation would occur on the:
    (1) 14^{th} day
    (2) 18^{th} day
    (3) 28^{th} day
    (4) 5^{th} day
40. Which of the following is not an effect of stimulation of sympathetic nervous system?
    (1) Dilation of pupil
    (2) Inhibition of peristalsis
    (3) Elevation of blood pressure
    (4) Stimulation for saliva secretion

41. The first stable compound in C_4 pathway is formed in
(1) Chloroplast of mesophyll cells
(2) Chloroplast of Bundle sheath cells
(3) Cytosol of mesophyll cells
(4) Cytosol of Bundle sheath cells

42. Clear cut vegetative, reproductive and senescent phases are seen in
(1) *Cycas*
(2) *Pinus*
(3) *Ficus*
(4) *Oryza*

43. Identify the odd one based on the type of fusing gametes
(1) *Fucus*
(2) *Cladophora*
(3) *Cycas*
(4) *Pinus*

44. Statement-I : Gametes are always formed by Meiosis.
Statement-II : Gametes are Haploid.
(1) Both Statement I and Statement II are correct
(2) Statement I is correct, Statement II is wrong
(3) Statement I is wrong, Statement II is correct
(4) Both Statement I and Statement II are wrong

45. If anther is microsporophyll, then embryosac is
(1) Female gamete
(2) Female gametophyte
(3) Ovule
(4) Ovary

46. During generation of a nerve impulse, the Action Potential results from the movement of:
(1) K^+ ions from intracellular fluid to extracellular fluid
(2) Na^+ ions from extracellular fluid to intracellular fluid
(3) K^+ ions from extracellular fluid to intracellular fluid
(4) Na^+ ions from intracellular fluid to extracellular fluid

47. Corneal transplantation is generally successful in humans as:
(1) cornea lacks blood supply
(2) it is a transparent membrane
(3) it lacks nerve fibres
(4) it is a dead structure

48. Choose the incorrect match:
(1) Myopia – short sightedness
(2) Hypermetropia – Can be corrected by using concave lens
(3) Cataract – Opaque lens
(4) Glaucoma – increased intraocular pressure

49. Which of the following is correct for 'pars nervosa'?
(1) It stocks and releases hormones synthesised by hypothalamus
(2) It synthesises many hormones of its own
(3) It is present in childhood but gets atrophied in adults
(4) It is vestigial in humans

50. Name the basic structural and functional unit of the nervous system.
    (1) Neuroglia
    (2) Glial cells
    (3) Neurons
    (4) Perikaryon

51. The number of male gametes involved in double fertilization
    (1) 3
    (2) 4
    (3) 2
    (4) 5

52. Pollination is maize is
    (1) Entomophily
    (2) Hydrophily
    (3) Malocophily
    (4) Anemophily

53. Identify the incorrect statement
    (1) PEN divides to form endosperm tissue after embryogenesis
    (2) Endosperm development precedes embryo development
    (3) Monocot seeds are generally endospermic
    (4) Cells of Aleurone layer are triploid

54. Gametes are
    (1) Always heterozygous
    (2) Always homozygous
    (3) Always hemizygous
    (4) Always diploid

55. Pea plant having Bb genotype shows complete dominance for
    (1) Shape of starch grain
    (2) Size of starch grain
    (3) Size of the seed
    (4) Shape of the seed

56. Calculation, contemplation and cognition are human activities associated with increased activity in the:
    (1) Cerebrum
    (2) Cerebellum
    (3) Spinal cord
    (4) Pituitary gland

57. Read the statements regarding muscle proteins:
    I. Each F-actin strand is composed of a string of subunits called globular (G) actin
    II. Regulatory protein troponin is distributed at regular intervals on myosin filaments
    III. Myosin is a thick filament which is also a polymerized protein
    IV. The globular head of meromyosin consists of light meromyosin (LMM)

    Which of the above statements are correct?
    (1) I, II and III
    (2) I, II and IV
    (3) I and III
    (4) II and IV

58. The most freely movable joint of all synovial joints is:
    (1) Ball and socket joint
    (2) Hinge joint
    (3) Pivot joint
    (4) Gliding joint

59. Motor neurons electrically stimulate nearby muscle fibres at _____

(1) Creatine phosphate

(2) Actin filament

(3) Neuromuscular junction

(4) Cross-bridges

60. Which of the following statements is correct about excretion?

(1) Humans excrete 25-30 grams of urea per day

(2) Glucose and amino acid are reabsorbed passively in renal tubules

(3) Descending limb of loop of Henle is impermeable to water

(4) Kidneys reabsorb about 30% volume of glomerular filtrate

61. Identify the incorrect statement regarding genetic material of $\phi x 174$ bacteriophage

(1) It is a polymer having ribose sugars

(2) Chargaff rule is not applicable to it

(3) It contains adenine, guanine, thymine, cytosine

(4) Two successive nucleotides are linked by phosphodiester bonds

62. Identify the incorrect statement regarding genetic code

(1) Code is degenerate

(2) Code is nearly universal

(3) Code is unambiguous and specific

(4) UUU codes for glycine

63. In prokaryotes, predominant site for control of gene expression is

(1) Elongation step

(2) Termination step

(3) Processing of hn RNA

(4) Initiation step of transcription

64. Corn borer is controlled by the following gene

(1) cry II Ab

(2) cry IAc

(3) cry II Ac

(4) cry I Ab

65. Total number of ATP's formed by all reduced coenzymes during oxidation of one glucose molecule

(1) 38

(2) 40

(3) 34

(4) 36

66. Dialysing unit (artificial kidney) contains a fluid which is almost same as blood plasma, except that it has:

(1) High levels of glucose

(2) High levels of urea

(3) No nitrogenous wastes

(4) High levels of creatinine

67. Within a normally functioning kidney, blood can be found in:

(1) the lumen of renal pelvis

(2) the vasa recta

(3) the Henle's loop

(4) the collecting ducts

68. Which of the following is devoid of muscle layer?

(1) Capillaries

(2) Arterioles

(3) Veins

(4) Arteries

69. The white fibres are chemically formed of
(1) Actin
(2) Collagen
(3) Myosin
(4) Elastin

70. Which of the following granulocytes arrive at the earliest at the site of infection?
(1) Eosinophils
(2) Basophils
(3) Neutrophils
(4) Monocytes

71. While isolating DNA from bacteria, which of the following enzymes is not used ?
(1) Lysozyme
(2) Ribonuclease
(3) Protease
(4) Deoxyribonuclease

72. In RNAi , mRNA is silenced using
(1) ssDNA
(2) dsDNA
(3) dsRNA
(4) ssRNA

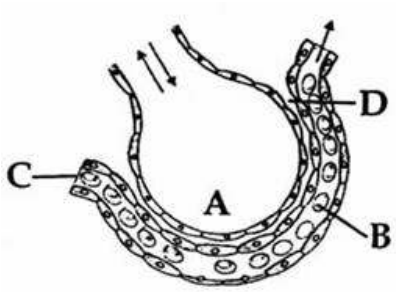
73. Which of the following step in PCR is catalysed by Taq polymerase ?
(1) Denaturation of template DNA
(2) Annealing of primers to DNA templates
(3) Primer extension on template DNA
(4) All of these

74. Sonalika is a variety of
(1) Wheat
(2) Rice
(3) Millet
(4) Tobacco

75. Black rot of crucifers is caused by
(1) Bacteria
(2) Fungi
(3) Nematode
(4) Virus

76. A healthy human has, on an average, _____ million RBCs per mm^3 of blood.
(1) 3 – 3.5 billion
(2) 2 – 2.5 million
(3) 5 – 5.5 million
(4) 6000 – 8000

77. The figure given below shows a small part of human lung where exchange of gases takes place. In which one of the options given below, the one-part A, B, C or D is correctly identified along with its function?



1) B : Red blood cell - transport of CO_2 only
2) C : Arterial capillary - passes oxygen to tissues
3) A : alveolar cavity - main site of exchange of respiratory gases
4) D : Capillary wall - exchange of O_2 and CO_2 takes place here

78. The micelle formation is generally not needed for the absorption of:
(1) Fatty acids
(2) Vitamins A, D, E & K
(3) Glycerol
(4) Amino acids

79. Brush border columnar epithelium is the lining of:
(1) Oesophagus
(2) Small intestine
(3) Stomach
(4) Proximal convoluted tubules

80. The function of typhlosole in earthworms is to:
(1) Secrete digestive juice
(2) Regulate the blood flow
(3) Emulsify the fatty foods
(4) Increase absorptive surface area of intestines

81. North Indian sugar variety is
(1) S. officinarum
(2) S. barberi
(3) Co 785
(4) Kalyansona

82. Methanogenic bacteria are not found in
(1) rumen of cattle
(2) gobar gas plant
(3) bottom of water-logged paddy fields
(4) activated sludge

83. Match the following list of bacteria and their commercially important products

Bacterium	Product
A) *Aspergillus niger*	i) Lactic acid
B) *Acetobacter aceti*	ii) Butyric acid
C) *Clostridium butylicum*	iii) Acetic acid
D) *Lactobacillus*	iv) Citric acid

Choose the correct match

	A	B	C	D
(1)	ii	iii	iv	i
(2)	ii	iv	iii	i
(3)	iv	iii	ii	i
(4)	iv	i	iii	ii

84. Which one of the following alcoholic drinks is produced without distillation ?
(1) Wine
(2) Whisky
(3) Rum
(4) Brandy

85. Which one of the following statements is correct for secondary succession ?
(1) It occurs on a deforested site
(2) It begins on a bare rock
(3) It is similar to primary succession except that it is relatively slow
(4) Occurs in newly created pond

86. Malpighian tubules in cockroaches:
(1) Are attached to gizzard
(2) Convert nitrogenous wastes into uric acid
(3) Lie at the junction of foregut and midgut
(4) Remain isolated from haemolymph

87. Match the columns:

Column – I		Column - II	
A.	Hyaline cartilage	i)	Intervertebral disc and pubic symphysis
B.	White-fibrous cartilage	ii)	Tip of nose
C.	Elastic cartilage	iii)	Foetal skeleton

(1) A = (iii), B = (ii), C = (i)
(2) A = (ii), B = (iii), C = (i)
(3) A = (iii), B = (i), C = (ii)
(4) A = (i), B = (ii), C = (iii)

88. True about *Ascidia, Branchiostoma, Doliolum, Salpa is*

(1) All are non-chordates except *Branchiostoma*

(2) All are urochordates except *Branchiostoma*

(3) All are chordates except *Branchiostoma*

(4) All are protochordates except *Branchiostoma*

89. Which among these is the correct combination of aquatic mammals?

(1) Seals, Dolphins, Sharks

(2) Dolphins, Seals, *Trygon*

(3) Whales, Dolphins, Seals

(4) *Trygon*, Whales, Seals

90. *Meandrina* is:

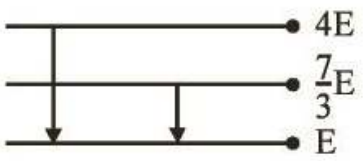
(1) the Brain coral

(2) an arthropod

(3) the sea anemone

(4) a hemichordate

91. The following diagram indicates the energy levels of a certain atom, where the system moves from 4E level to E, a photon of wavelength λ_1 is emitted. The wavelength of photon produced during its transition from $\frac{7}{3}E$ level to E is λ_2. The ratio $\frac{\lambda_1}{\lambda_2}$ will be



(1) $\frac{9}{4}$

(2) $\frac{4}{9}$

(3) $\frac{3}{2}$

(4) $\frac{7}{3}$

92. All electron ejected from a surface by incident of wavelength 200 nm can be stopped before travelling 1 meter in the direction of a uniform electric field of $4\,NC^{-1}$ the work function of the surface is

(1) 4 eV

(2) 5.2 eV

(3) 3 eV

(4) 2.2 eV

93. The de Broglie wavelength of an electron moving with a velocity $1.5\times10^{8}\,m/s$ is equal to that of a photon. The ratio of the kinetic energy of the electron to the energy of the photon is

(1) $\frac{1}{4}$

(2) $\frac{1}{2}$

(3) 2

(4) 4

94. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 27:1. The ratio of radii of the fragments is

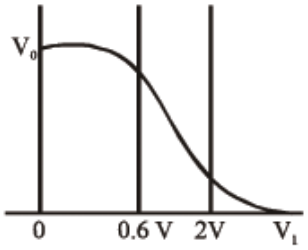
(1) $1:3\sqrt{3}$

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

(3) 1 : 3

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

95. Figure shows the transfer characteristics of a base biased CE transistor. Which of the following statements is FALSE?



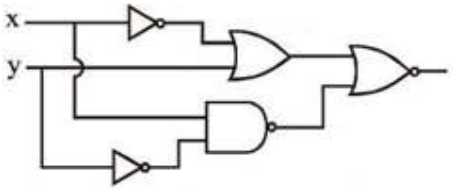
(1) At $V_i = 1V$, it can be used as an amplifier

(2) At $V_i = 0.5V$, it can be used as a switch turned off.

(3) At $V_i = 2.5V$, it can be used as a switch turned on

(4) At $V_i = 0.4V$, transistor is in active state

96. To produce high output (1) at R, we must have input x and y respectively



(1) x = 0, y = 1

(2) x = 1, y = 1

(3) x = 1, y = 0

(4) x = 0, y = 0

97. The breakdown in a reverse biased p-n junction diode is more likely to occur due to

(a) large velocity of the minority charge carriers if the doping concentration is small

(b) large velocity of the minority charge carriers if the doping concentration is large

(c) strong electric filed in the depletion region if the doping concentration is small

(d) strong electric filed in the depletion region if the doping concentration is large

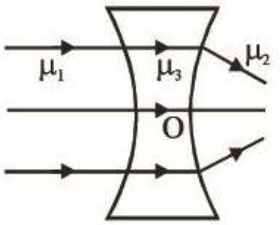
(1) a, d

(2) c only

(3) b only

(4) b, c

98. From the figure shown here, establish a relation between μ_1, μ_2 and μ_3



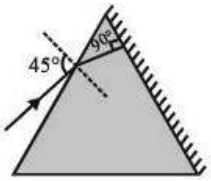
(1) $\mu_1 < \mu_2 < \mu_3$

(2) $\mu_3 < \mu_2;\ \mu_3 = \mu_1$

(3) $\mu_3 > \mu_2;\ \mu_3 = \mu_1$

(4) $\mu_1 > \mu_2 > \mu_3$

99. One face of a prism with a refractive angle of 30^0 is coated with silver. A ray incident on another face at an angle of 45^0 is refracted at first surface, reflected from the silver coated face and retraces its path. What is the refractive index of the prism?



(1) $\sqrt{2}$

(2) $\sqrt{3}$

(3) $\frac{3}{2}$

(4) $\frac{4}{3}$

100. The magnifying power of an astronomical telescope in the normal adjustment position is 100. The distance between the objective and the eye piece is 101 cm. Find the focal length of the objective lens

(1) 1 cm

(2) 100 cm

(3) 50 cm

(4) 51 cm

101. In young's double slit experiment with pin holes, the interference pattern on the screen, placed perpendicular to line of pin holes, is

(1) Parabolic

(2) Straight

(3) Hyperbolic

(4) Circular

102. A screen is place 50 cm from a single slit, which is illuminated with $6000\overset{o}{A}$ light. If the distance between the first and third minima in the diffraction pattern is 3 mm, the width of the slit is

(1) 0.1 mm

(2) 0.2 mm

(3) 0.3 mm

(4) 0.4 mm

103. Two wires of resistances R_1 and R_2 have temperature coefficient of resistance α_1 and α_2 respectively. These are joined in series the effective temperature coefficient of resistance is

(1) $\frac{\alpha_1+\alpha_2}{2}$

(2) $\sqrt{\alpha_1\alpha_2}$

(3) $\frac{\alpha_1 R_1+\alpha_2 R_2}{R_1+R_2}$

(4) $\frac{\sqrt{R_1R_2\alpha_1\alpha_2}}{\sqrt{R_1^2+R_2^2}}$

104. A potentiometer wire has length 4m and resistance 6Ω. The resistance that must be connected in series with the wire and a battery of emf 4V so as to get a potential gradient 5mV per cm on the wire is

(1) 6Ω

(2) 12Ω

(3) 18Ω

(4) 24Ω

105. If a number of forces act on a body and the body is in static or dynamic equilibrium, then

(1) Work done by any individual force must be zero

(2) Net work done by all the forces is +ve

(3) Net work done by all the forces is -ve

(4) Net work done by all the forces is zero

106. The velocities of two particles A and B of same mass are $\vec{V}_A = a\hat{i}$ and $\vec{V}_B = b\hat{i}$ where a and b are constants. The acceleration of particle A is $\left(2a\hat{i}+4b\hat{i}\right)$ and acceleration of particle B is $\left(a\hat{i}-b\hat{i}\right)$ (in m/s^2). The path of the centre of mass of two particles is

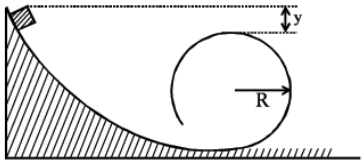
(1) Straight line

(2) Parabola

(3) Ellipse

(4) Circle

107. A small object of mass m starts from rest at the position shown and slides along the frictionless loop-the-loop track of radius R. What is the smallest value of y such that the object will slide without losing contact with the track?



(1) $\frac{R}{2}$

(2) R

(3) $\frac{R}{4}$

(4) $\frac{3R}{4}$

108. The frequency of vibration of a string is given by $v=\frac{P}{2l}\left[\frac{F}{m}\right]^{1/2}$ here p is the number of segments in which the string is divided, F is the tension in the string and l is its length. The dimensional formula for m is

(1) $\left[M^0L^0T^0\right]$

(2) $\left[ML^{-1}T^0\right]$

(3) $\left[ML^0T^{-1}\right]$

(4) $\left[M^0LT^{-1}\right]$

109. An object moving with a speed of 6.25 m/s, is retarded by $2.5\sqrt{v}$. Where v is instantaneous speed. The time taken by the object to come to rest, would be

(1) 1 s

(2) 2 s

(3) 4 s

(4) 8 s

110. A fixed pulley of radius 20 cm and moment of inertia $0.32\,kg.m^2$ about its axle has a massless cord wrapped around its rim. A mass M of 2 kg is attached to the end of the cord. The pulley can rotate about its axis without any friction. The acceleration of the mass M is (Assume $g=10\,m/s^2$)

(1) $1\,m/s^2$

(2) $3\,m/s^2$

(3) $2\,m/s^2$

(4) $4\,m/s^2$

111. A particle thrown at an angle of 30^o with the horizontal has a range R_1 and maximum vertical height H_1. The another particle with double the mass when thrown from the same point with the same velocity at an angle of 30^o with the vertical has a range R_2 and maximum vertical height H_2. Choose the correct relation

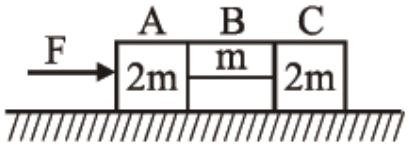
(1) $R_1=R_2;\ H_1=3H_2$

(2) $R_1=R_2;\ H_1=\frac{H_2}{3}$

(3) $R_1=\frac{R_2}{3};\ H_1=H_2$

(4) $R_1=3R_2;\ H_1=H_2$

112. The system is pushed by a force F as shown in figure. All surfaces are smooth except between B and C. Friction coefficient between B and C is μ. Minimum value of F to prevent block B from downward slipping is



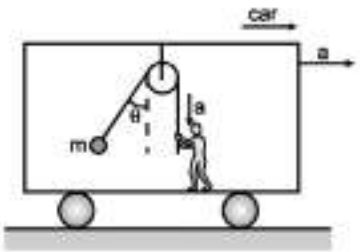
(1) $\left(\frac{3}{2\mu}\right)mg$

(2) $\left(\frac{5}{2\mu}\right)mg$

(3) $\left(\frac{5}{2}\right)\mu mg$

(4) $\left(\frac{3}{2}\right)\mu mg$

113. A boy is hanging over a pulley inside a car through a string. The second end of the straight is in the hand of a person standing in the car. The car is moving with constant acceleration 'a' directed horizontally as shown in figure. Other end of the straight is pulled with constant acceleration 'a' (relative to car) vertically. The tension in the string is equal to



(1) $m\sqrt{g^2+a^2}$

(2) $m\sqrt{g^2+a^2}-ma$

(3) $m\sqrt{g^2+a^2}+ma$

(4) m (g + a)

114. A ballet dancer spins about a vertical axis at 60 rpm with his arms closed. Now he stretches his arms such that M.I increases by 50%. The new speed of revolution is.

(1) 80 rpm

(2) 40 rpm

(3) 90 rpm

(4) 30 rpm

115. The escape velocity from a planet is v_e. A tunnel is dug along the diameter of the planet and a small body dropped into it. The speed of the body at the centre of the planet will be

(1) $\frac{v_e}{\sqrt{2}}$

(2) $\frac{v_e}{2}$

(3) v_e

(4) $2v_e$

116. The height at which the weight of a body becomes $1/9^{th}$ its weight on the surface of earth (radius of earth is R)

(1) h = 3 R

(2) h = R

(3) $h=\frac{R}{2}$

(4) h = 2R

117. Steam at 100^0C is passed into 22g of water at 20^0C. The mass of water that will be present when the water acquires a temperature of 90^0C (Latent heat of steam is 540 cal/g) is

(1) 24.8 g

(2) 24 g

(3) 36.6 g

(4) 2.8 g

118. A gaseous mixture consists of 16 g of helium and 16 g of oxygen. The ratio $\left(C_p / C_v\right)$ of the mixture is

(1) 1.4

(2) 1.54

(3) 1.59

(4) 1.62

119. A black body has maximum wavelength λ_m at 2000 K. Its corresponding wavelength at 3000 K will be

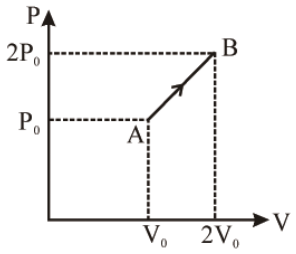
(1) $\frac{16}{81}\lambda_m$

(2) $\frac{81}{16}\lambda_m$

(3) $\frac{3}{2}\lambda_m$

(4) $\frac{2}{3}\lambda_m$

120. The P-V diagram of 2g of helium gas for a certain process $A \to B$ is shown in the figure. What is the work done by the gas during the process $A \to B$?



(1) $1.5P_0V_0$

(2) $6P_0V_0$

(3) $4.5P_0V_0$

(4) $2P_0V_0$

121. A refrigerator placed in a room at 300 K has inside temperature 200 K. How many calories of heat shall be delivered to the room for each 2 Kcal of energy consumed by the refrigerator ideally?

(1) 4 Kcal

(2) 2 Kcal

(3) 8 Kcal

(4) 6 Kcal

122. When the stress is numerically equal to half of the young's modulus, the final length of the wire if the initial length is L

(1) 3 L

(2) 2 L

(3) 1.5 L

(4) 4.5 L

123. When a ball is released from rest in a very long column of viscous liquid, its downward acceleration is 'a' (just after release). Then its acceleration when it has acquired two third of the maximum velocity

(1) $\frac{a}{3}$

(3) $\frac{2a}{3}$

(3) $\frac{a}{6}$

(4) $\frac{2a}{5}$

124. The potential energy of a particle of mass 1 kg in motion along the x-axis is given by U = 4 (1 – cos 2x) J Here : x is in metres. The period of small oscillations (in sec) is

(1) 2π

(2) π

(3) $\frac{\pi}{2}$

(4) $\sqrt{2}x$

125. A string clamped at both ends is vibrating. At the moment the string looks flat, the instantaneous transverse velocity of points along the string, excluding its end-points, must be

(1) zero everywhere

(2) dependent on the location along the string

(3) non zero everywhere

(4) non zero and in the same direction everywhere

126. An air craft moving horizontally at an altitude with a speed equal to half of velocity of sound, produces a sound of frequency 3K Hz. What is apparent frequency heard by an observer on the ground at the instant when the air craft is moving over the head of him

(1) 2.1K Hz

(2) 3 K Hz

(3) 3.5 K Hz

(4) 4 K Hz

127. A long solenoid has 1000 turns per metre and carries a current of 1 a. It has a soft iron core of $\mu_r = 1000$. The core is heated beyond the Curie temperature, T_c.

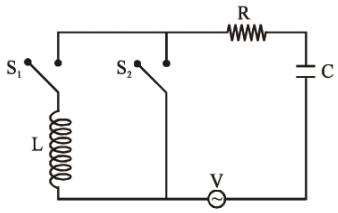
(1) The H field in the solenoid is (nearly) unchanged but the B field decreases drastically

(2) The H and B fields in the solenoid are nearly unchanged

(3) The magnetisation in the core reverses direction

(4) The magnetisation in the core diminishes by a factor of about 10

128.



When S_1 is closed and S_2 is open $V_L = V_R = V_C = 10V$. What will be the value of V_C if S_1 opened and S_2 is closed?

(1) 10

(2) $10\sqrt{2}$

(3) $\frac{10}{\sqrt{2}}$

(4) $15\sqrt{2}$

129. A conducting circular loop of radius a and resistance R is kept on horizontal plane. A vertical time varying magnetic field B = 2t is switched on at time t = 0. Then

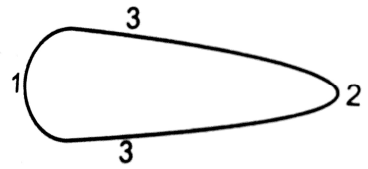
(1) power generated in the coil at any time is constant

(2) flow of charge per unit time from any section of the coil is constant

(3) total charge passed through any section between time t = 0 to $t = 2s, \left(\frac{4\pi a^2}{R}\right)$

(4) all of the above

130. Consider a non spherical conductor shown in the figure which is given a certain amount of positive charge. The charge distributes itself on the surface such that the charge densities are σ_1, σ_2 and σ_3 at the region 1, 2 and 3 respectively. Then



(1) $\sigma_1 > \sigma_2 > \sigma_3$

(2) $\sigma_2 > \sigma_3 > \sigma_1$

(3) $\sigma_3 > \sigma_1 > \sigma_2$

(4) $\sigma_2 > \sigma_1 > \sigma_3$

131. Two equal point charges q are fixed at x = - a and x = + a on x-axis. Another point charge Q is placed at the origin. The change in electrical potential energy of Q, when it is displaced by a small amount x along x-axis, is approximately proportional to

(1) x

(2) x^2

(3) x^3

(4) $\frac{1}{x}$

132. The average electric field of electromagnetic waves in certain region of free space is $9\times10^{-4}\,NC^{-1}$. Then, the average magnetic field in the same region is of the order of

(1) $27\times10^{-4}\,T$

(2) $3\times10^{-12}\,T$

(3) $\left(\frac{1}{3}\right)\times10^{-12}\,T$

(4) $3\times10^{12}\,T$

133. A parallel plate capacitor is charged from a cell then isolated from it. The separation between it's plates is now increased then the force of attraction between the plates

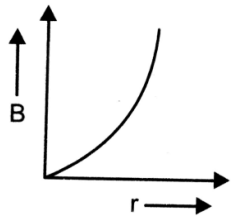
(1) will decrease

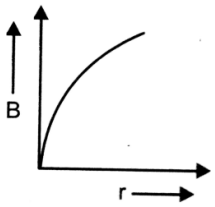
(2) will increase

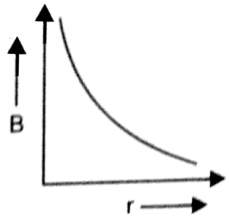
(3) will increase or decrease depending on charge

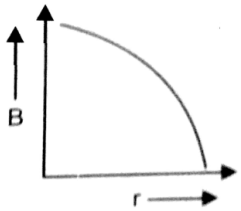
(4) will remains same

134. The graph showing the variation of the magnetic field strength (B) with distance (r) from a long current carrying conductor is

(1) 

(2) 

(3) 

(4) 

135. The instantaneous acceleration of an electron in a magnetic field $\bar{B}=2\bar{i}+3\bar{j}+4\bar{k}$ is $\bar{a}=x\bar{i}+\bar{j}-\bar{k}$. The magnitude of acceleration is

(1) 0.5 units

(2) 1.5 units

(3) $\sqrt{0.5}$ units

(4) $\sqrt{2.5}$ units

136. Total number of nodes, the planar nodes and the radial nodes in case of 4f orbital respectively are

(1) 4 , 3 , 2

(2) 3 , 3 , 0

(3) 3 , 2 , 1

(4) 4 , 2 , 1

137. A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to that of hydrogen is 16. The molecular formula of the compound is

(1) N_2H

(2) NH_2

(3) N_2H_4

(4) N_2H_6

138. Equal volumes of two solutions with pH values 2 & 6 are mixed together. pH of resulting solution is:

(1) 4

(2) 6.3

(3) 2.3

(4) 7

139. Which of the given statements incorrect

(1) Keratin & Myosin are fibrous proteins

(2) Deficiency of vitamin C causes scurvy

(3) Nucleoside contains pentose sugar + Purine or pyrimidine base + phosphate

(4) Glucosazone formation from glucose requires 3 moles of phenyl hydrazine

140. For a hypothetical reaction, the activation energy is zero. What is the rate constant at 400K if at 300K its value is 2.5×10^5 sec^{-1}?

(1) 5.0×10^5 sec^{-1}

(2) 1.0×10^5 sec^{-1}

(3) 3.0×10^6 sec^{-1}

(4) 2.5×10^5 sec^{-1}

141. Volume of 98% (w/w) H_2SO_4 of specific gravity 1.8 required to prepare one litre of 1.8M solution is

(1) 10 ml

(2) 200 ml

(3) 100 ml

(4) 500 ml

142. Which of the following can act as both Lewis acid and Lewis base

(1) SO_3

(2) SF_4

(3) CO

(4) SiF_6^{-2}

143. The solubility product of $Pb(OH)_2$ in water is 8.64×10^{-16} M. The solubility of $Pb(OH)_2$ in a buffer solution of pH= 10 is

(1) 3.5×10^{-10} M

(2) 8.64×10^{-8} M

(3) 2.2×10^{-6} M

(4) 8.64×10^{-2} M

144. $C_2O^{-2} + MnO_4^{-1} \rightarrow Mn^{+2} + CO_2$, this reaction takes place in :

(1) Basic medium

(2) Neutral medium

(3) Acidic medium

(4) Strong alkaline medium

145. In a reversible reaction $K_c < K_p$ and $\Delta H = +40$ K. Cal / mole. Forward reaction is favoured by

(1) Increasing both pressure & temperature

(2) Decreasing both pressure & temperature

(3) Decreasing pressure & increasing temperature

(4) Increasing pressure & decreasing temperature

146. Oxidation number of potassium in K_2O, K_2O_2 and KO_2, respectively is:

(1) +1, +2 and +4

(2) +1, +4 and +2

(3) +2, +1 and $+\frac{1}{2}$

(4) +1, +1 and +1

147. Which among the following has highest boiling point?

(1) 0.5 M Glucose(aq)

(2) 0.5 M NaCl(aq)

(3) 0.5 M $CaCl_2$(aq)

(4) 0.5 M $Al_2(SO_4)_3$ (aq)

148. Given that the standard potential (E°) of Cu^{2+}/Cu and Cu^{+}/Cu are 0.34 V and 0.522 V respectively, the E° of Cu^{2+}/Cu^{+} is:

(1) 0.182V

(2) − 0.158V

(3) − 0.182 V

(4) +0.158 V

149. For the reaction $P(l) \rightarrow Q(g)$

$\Delta U = 2.1 Kcal$ & $\Delta S = 15 calK^{-1}$ at $300K$.

Hence ΔG is Kcal is:

(1) − 1.8

(2) 2.1

(3) − 2.5

(4) 2.9

150. The bond order and magnetic characteristics of CN^- are :

(1) 3, diamagnetic

(2) $2\frac{1}{2}$, diamagnetic

(3) $2\frac{1}{2}$, paramagnetic

(4) 3, paramagnetic

151. Which among the following is incorrect statement?

(1) The refining method used when the metal and the impurities have low and high melting temperatures respectively is liquation

(2) Wrought iron is the purest form of iron

(3) Zone refining is preferred if impurities are more soluble in molten metal than in solid metal

(4) The leaching agent used in the concentration of Bauxite is H_2SO_4

152. The flocculation value of HCl for arsenic sulphide sol is 30 milli mol L^{-1}. If H_2SO_4 is used for the flocculation of arsenic sulphide, then the amount in grams of H_2SO_4 required for 500 ml in the above purpose is :

(1) 1.65g

(2) 0.735g

(3) 4.53g

(4) 0.35g

153. Which among the following is correct statement?

(1) Drugs which bind to the active site of enzyme are called allosteric drugs

(2) A chemical messenger gives message to the cell by entering the cell

(3) Drugs which compete with natural substrate on active site are called competitive inhibitors

(4) Morphine can be used as analgesic without causing addiction.

154. A vessel of volume 1 litre contains 1 mole of nitrogen gas at a temperature 12.18K. The pressure of the gaseous mixture, when 50% of the molecules are dissociated into nitrogen atoms at the same temperature is:

(1) 4.5 atm

(2) 1.5 atm

(3) 3.8 atm

(4) 2.9 atm

155. Which among the following is a condensation polymer?

(1) Teflon

(2) Buna-S

(3) Nylon-6

(4) Polythene

156. In a sample of FeO, when 12 Fe^{+2} ions are replaced with electrically balanced number of Fe^{+3} ions , then the composition of FeO is:

(1) $Fe_{0.88}O$

(2) $Fe_{0.96}O$

(3) $Fe_{0.82}O$

(4) $Fe_{0.79}O$

157. A disaccharide consisting of two α-D-glucose units in which C_1 of one glucose is linked to C_4 of another α-D-glucose unit is:

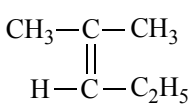
(1) Maltose

(2) Sucrose

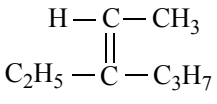
(3) Lactose

(4) Celulose

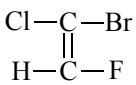
158. The Z-isomer among the following are



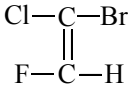
I



II



III



IV

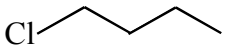
(1) I, II

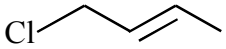
(2) II, III

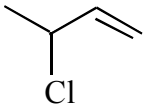
(3) III, IV

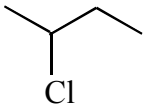
(4) I, IV

159. Arrange the following compounds in order of dehydrohalogenation (E_1) reaction

A) 

B) 

C) 

D) 

(1) C > B > D > A

(2) C > D > B > A

(3) B > C > D > A

(4) A > B > C > D

160. Which of the following reactions do not result in the formation of new C - C bond

(1) Fittig reaction

(2) Wurtz reaction

(3) Wurtz - Fittig reaction

(4) Williamson's synthesis

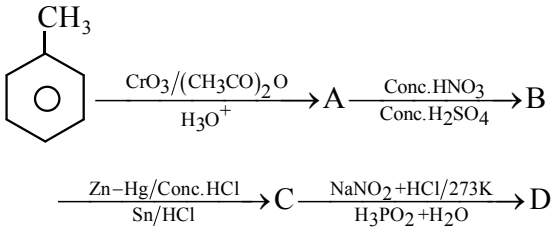
161. Number of S – O bond in $S_2O_8^{-2}$ and number of S – S bond in rhombic sulphur are respectively

(1) 8, 8

(2) 6, 8

(3) 2, 4

(4) 4, 2

162. 

IUPAC name of 'D' is

(1) 3 – hydroxyl benzaldehyde

(2) Benzene carbaldehyde

(3) Methyl benzene

(4) Benzene 1, 3 diol

163. Incorrect combination among hydrides of Halogens is

(1) Acidic nature : HF> HCl > HBr > HI

(2) Reducing nature : HI > HBr > HCl > HF

(3) Boiling points : HF> HI > HBr > HCl

(4) Volatility : HCl > HBr > HI > HF

164. XeO_3 is formed on hydrolysis of

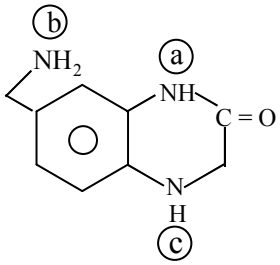
A) XeF_2 B) XeF_4 C) XeF_6

1) only A,B

2) only A,C

3) only B, C

4) only A,B,C

165. 

Correct order of electron donating power of nitrogen is

(1) a > b > c

(2) c > b > a

(3) b > c > a

(4) b > a > c

166. 35.5g of organic compound is acidified with HNO_3. On addition of $AgNO_3$, 14.35g of AgCl is precipitated. Percentage of chlorine in sample is

(1) 20%

(2) 10%

(3) 40%

(4) 5%

167. Statement-I : Down the group solubility of IIA group hydroxides increases

Statement-II : Down the group in IIA group hydroxides, decrease in lattice enthalpy is more than decrease in hydration enthalpy

(1) I and II are true

(2) I and II are false

(3) I is true, II is false

(4) I is false, II is true

168. CH_3CHO and CH_3COCH_3 cannot be distinguished by

(1) Tollens Test

(2) Benedicts Test

(3) lodoform Test

(4) Schiff's Test

169. Number of carboxylic acids and esters (strucrtural only) possible with the formula $C_4H_8O_2$ are

(1) 6

(2) 4

(3) 5

(4) 3

170. When NH_4NO_3 is gently heated, an oxide of nitrogen is formed, the oxidation state of nitrogen in this oxide is

(1) + 4

(2) + 2

(3) + 3

(4) + 1

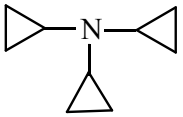
171. Which of the following ions is most stable

(1) Sn^{+2}

(2) Ge^{+2}

(3) Si^{+2}

(4) Pb^{+2}

172. The IUPAC name of  is

(1) Tricyclo propylamine

(2) N, N – dicyclopropylamine

(3) N, N dicyclo propyl cyclopropanamine

(4) N, N, N tricyclo propanamine

173. Which of the following metal is having least melting point ?

(1) Na

(2) K

(3) Rb

(4) Cs

174. According to crystal field theory, the M – L bond in a complex is

(1) partially covalent

(2) purely ionic

(3) purely covalent

(4) purely co-ordinate

175. $C_6H_5CN \xrightarrow[\text{hydrolysis}]{\text{Partial}} A \xrightarrow{Br_2/NaOH(NaOBr)} B.$

Which of the following cannot be used as an acylating agent to B

(1) CH_3COOH

(2) CH_3COCl

(3) $(CH_3CO)_2O$

(4) $CH_3COOC_2H_5$

176. Correct order of radius of elements C, O, F, Cl, Br is

(1) Br < Cl < C < O < F

(2) Br > Cl > C > O > F

(3) Cl < C < O < F < Br

(4) C > F > O > Br > Cl

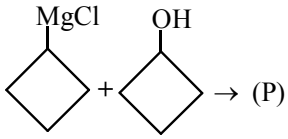
177. The electronic configuration of bivalent Europium and trivalent Cerium respectively is [Z for Xe = 54, Ce = 58, Eu = 63]

(1) $[Xe]4f^7, [Xe]4f^1$

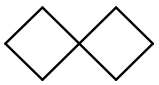
(2) $[Xe]4f^7 6s^2, [Xe]4f^1$

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

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

178.  . Compound (P) is :-

(1) 

(2) 

(3) 

(4) 

179. Wrong match is

(1) Borax ….. undergoes anionic hydrolysis

(2) Orthoboric acid ….. Lewis acid

(3) Solid CO_2 …. Refrigerant

(4) Keiselghur …. Crystalline form of silica

180. Which of the following water sample is more polluted ?

(1) DO -4ppm , BOD-4ppm

(2) DO -2ppm , BOD-150ppm

(3) DO -2ppm , BOD-5ppm

(4) DO -3ppm , BOD- 2ppm

SRI CHAITANYA EDUCATIONAL INSTITUTIONS,INDIA

A.P,TELANGANA,KARNATAKA,TAMILNADU,MAHARASHTRA,DELHI,RANCHI,CHANDIGARH

SR AIIMS S60 **NEET GRAND TEST - 4 KEY** **Date : 23-01-2020**

BOT : 1 – 5, 11 – 15, 21 – 25, 31 – 35, 41 – 45, 51 – 55, 61 – 65, 71 – 75, 81 – 85

ZOO : 6 -10, 16 – 20, 26 – 30, 36 – 40, 46 – 50, 56 – 60, 66 – 70, 76 – 80, 86 – 90

BIOLOGY

1) **2**	2) **4**	3) **3**	4) **1**	5) **4**	6) **2**	7) **1**	8) **2**	9) **2**	10) **2**
11) **1**	12) **3**	13) **4**	14) **1**	15) **4**	16) **4**	17) **4**	18) **3**	19) **1**	20) **1**
21) **1**	22) **3**	23) **3**	24) **1**	25) **4**	26) **4**	27) **3**	28) **1**	29) **4**	30) **3**
31) **1**	32) **2**	33) **1**	34) **4**	35) **2**	36) **1**	37) **1**	38) **3**	39) **2**	40) **4**
41) **3**	42) **4**	43) **2**	44) **3**	45) **2**	46) **2**	47) **1**	48) **2**	49) **1**	50) **3**
51) **3**	52) **4**	53) **1**	54) **3**	55) **4**	56) **1**	57) **3**	58) **1**	59) **3**	60) **1**
61) **1**	62) **4**	63) **4**	64) **4**	65) **3**	66) **3**	67) **2**	68) **1**	69) **2**	70) **3**
71) **4**	72) **3**	73) **3**	74) **1**	75) **1**	76) **3**	77) **3**	78) **4**	79) **2**	80) **4**
81) **2**	82) **4**	83) **3**	84) **1**	85) **1**	86) **2**	87) **3**	88) **2**	89) **3**	90) **1**

PHYSICS

91) **2**	92) **4**	93) **1**	94) **3**	95) **4**	96) **3**	97) **1**	98) **2**	99) **1**	100) **2**
101) **4**	102) **2**	103) **3**	104) **1**	105) **4**	106) **1**	107) **1**	108) **2**	109) **2**	110) **3**
111) **2**	112) **2**	113) **3**	114) **2**	115) **1**	116) **4**	117) **1**	118) **4**	119) **4**	120) **1**
121) **4**	122) **3**	123) **1**	124) **3**	125) **2**	126) **4**	127) **1**	128) **3**	129) **4**	130) **4**
131) **2**	132) **2**	133) **4**	134) **3**	135) **2**					

CHEMISTRY

136) **2**	137) **3**	138) **3**	139) **3**	140) **4**	141) **3**	142) **2**	143) **2**	144) **3**	145) **3**
146) **4**	147) **4**	148) **4**	149) **1**	150) **1**	151) **4**	152) **2**	153) **3**	154) **2**	155) **3**
156) **2**	157) **1**	158) **2**	159) **1**	160) **4**	161) **1**	162) **3**	163) **1**	164) **3**	165) **3**
166) **2**	167) **1**	168) **3**	169) **1**	170) **4**	171) **4**	172) **3**	173) **4**	174) **2**	175) **1**
176) **2**	177) **1**	178) **4**	179) **4**	180) **2**					

91. Transition from (4E to E)

Energy of photon $4E - E = \frac{hc}{\lambda_1}$ thus $\lambda_1 = \frac{hc}{3E}$ ……. (1)

Transition from ($\frac{7}{3}E$ - E); $\frac{7}{3}E - E = \frac{hc}{\lambda_2}$ thus $\lambda_2 = \frac{3hc}{4E}$ …… (2)

Equation (1) & (2) $\frac{\lambda_1}{\lambda_2} = \frac{4}{9}$

92. $E = \frac{12400}{\lambda} = 6.2eV$

KE of electron $= eV = e\left(E \times d\right) = e\left(4 \times 1\right) = 4eV$

Work function = E- W = 2.2 eV

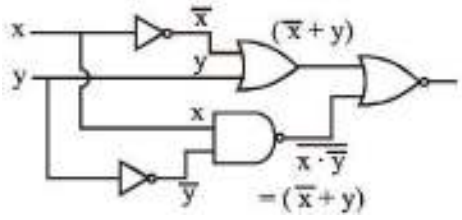
93. $\lambda_c = \lambda_p = \lambda$

$$\frac{E_e}{E_{ph}} = \frac{\frac{1}{2}m_e v_e^2}{\frac{hc}{\lambda_p}} \qquad \left(\therefore \lambda_e = \frac{h}{m_e v_e}\right.$$

$$\frac{\frac{1}{2}\left(\frac{h}{\lambda_e v_e}\right)v_e^2}{\frac{hc}{\lambda_p}} = \frac{v_e}{2c} \qquad \left\{\therefore \lambda_e = \lambda_p = \lambda\right\} = \frac{1.5 \times 10^8}{2 \times 3 \times 10^8} = \frac{1}{4}$$

94. $m_1 v_1 = m_2 v_2 \Rightarrow r_1^3 v_1 = r_2^3 v_2$

95. Conceptual

96. 

$R = \overline{\left(\bar{x}+y\right)+\left(\bar{x}+y\right)} = \overline{\bar{x}+y} = x.\bar{y}$

$R = x.\bar{y}$ for R = 1 $\Rightarrow$ x = 1 & y = 0

97. Conceptual

98. For second surface, $\frac{\mu_2}{v} - \frac{\mu_3}{\infty} = \frac{\mu_2 - \mu_3}{+R} \Rightarrow v = \frac{\mu_2 R}{\mu_2 - \mu_3}$ for v positive $\mu_2 > \mu_3$ and for first s $\mu_1 = \mu_3$

99. Given $A = 30^o$, $i_1 = 45^0$ and $r_2 = 0$

Since, $r_1 + r_2 = A \qquad \therefore \quad r_1 = A = 30^o$

Now refractive index of the prism, $\mu = \frac{\sin i_1}{\sin r_1} = \frac{\sin 45^0}{\sin 30^0} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \sqrt{2}$

100. $\frac{f_0}{f_e}=100;$ $f_0=100f_e$

$f_0+f_e=101 \Rightarrow 100f_e+f_e=101;\ f_e=1cm,\ f_0=100cm$

101. Conceptual

102. For minima $y=(n\lambda)\frac{D}{a}$

$(y_3-y_1)=(3-1)\lambda\left(\frac{D}{a}\right)=3mm$ a = 0.2mm

103. $\Delta R_{eq}=\Delta R_1+\Delta R_2$

$R_{eq}\alpha_{eq}\Delta T=R_1\alpha_1\Delta T+R_2\alpha_2\Delta T \Rightarrow \alpha_{eq}=\frac{R_1\alpha_1+R_2\alpha_2}{R_1+R_2}$

104. $L_{AB}=4m$ $R_{AB}=6\Omega$ E=4V

$x=\left(\frac{E}{R+R_s}\right)\frac{R}{L} \Rightarrow \frac{5\times10^{-3}}{10^{-2}}=\left(\frac{4}{R+6}\right)\frac{6}{4} \Rightarrow R=6\Omega$

105. Conceptual

106. $\vec{V}_{cm}=\frac{m_1\vec{V}_1+m_2\vec{V}_2}{m_1+m_2}=\frac{\vec{V}_1+\vec{V}_2}{2}=\frac{a\hat{i}+b\hat{j}}{2}$

$\vec{a}_{cm}=\frac{m_1\vec{a}_1+m_2\vec{a}_2}{m_1+m_2}=\frac{\vec{a}_1+\vec{a}_2}{2}=\frac{3}{2}\left(a\hat{i}+b\hat{j}\right)$

As $\vec{V}_{cm}$ is parallel to $\vec{a}_{cm}$ so path is a straight line.

107. $\sqrt{2gh}\geq\sqrt{5gh} \Rightarrow h\geq\frac{5R}{2}$

$h_{\min}=\frac{5R}{2} \Rightarrow y_{\min}=h_{\min}-2R=\frac{R}{2}$

108. $[v]=\left[T^{-1}\right]$ $[l]=\left[L^1\right]$ $[F]=\left[M^1L^1T^{-2}\right]$

$m=\frac{P^2F}{4v^2l^2} \Rightarrow [m]=\frac{[F]}{\left[v^2\right]\left[l^2\right]}=\frac{\left[M^1L^1T^{-2}\right]}{\left[T^{-2}\right]\left[L^2\right]} \Rightarrow [m]=\left[M^1L^{-1}\right]$

109. u = 6.25 m/s

$a=\frac{dV}{dt}=-\frac{5}{2}\sqrt{v} \Rightarrow -\frac{dV}{\sqrt{V}}=\frac{5}{2}dt \Rightarrow \int_u^0\frac{dV}{\sqrt{V}}=\frac{5}{2}\int_0^2 dt \Rightarrow \left[-\frac{\sqrt{V}}{1/2}\right]_u^0=\frac{5}{2}t \Rightarrow \sqrt{6.25}-0=\frac{5}{4}\times t \Rightarrow t=2s$

110. Mg – T = Ma for motion of M

$T\times R=I\alpha$ for motion of pulley

$T\times0.2=(0.32)\alpha \Rightarrow T=1.6\alpha=1.6\left(\frac{a}{0.2}\right)=8a$

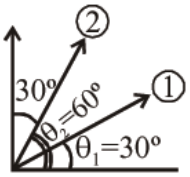
From Mg – T = Ma $\Rightarrow 20-8a=2a \Rightarrow a=2m/s^2$

111. Range of projectile is same for the angle of projection θ and $90^o-\theta$.

$\because\ \theta_1=30^o$ *and* $\theta_1=90^o-30^o=30^o$

Thus $R_1=R_2$

Also, $H=\frac{u^2\sin^2\theta}{2g}$ so that $H\propto\sin^2\theta$

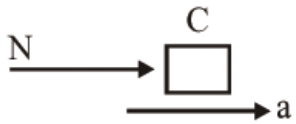


$$\therefore \frac{H_1}{H_2}=\frac{\sin^2 30^o}{\sin^2 60^o}=\frac{\left(\frac{1}{2}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2}=\frac{1}{3} \quad \Rightarrow H_1=\frac{H_2}{3}$$

112. Horizontal acceleration of the system is, $a=\frac{F}{2m+m+2m}=\frac{F}{5m}$

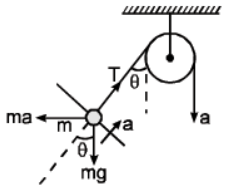
Lt N be the normal reaction between B and C.

Free body diagram of C gives $N=2ma=\frac{2}{5}F$



Now, B will not slide downward if $\mu N \geq m_B g$ or $\mu\left(\frac{2}{5}F\right)\geq mg$ or $F\geq\frac{5}{2\mu}mg$ so

$$F_{\min}=\frac{5}{2\mu}mg$$

113. 

(Force diagram in the frame of the car)

Applying Newton's law perpendicular to string $mg\sin\theta=mg\cos\theta \quad \Rightarrow \tan\theta=\frac{a}{g}$

Applying Newton's law along string $\Rightarrow T-m\sqrt{g^2+a^2}=ma \,/\, T=m\sqrt{g^2+a^2}+ma$

114. $I_1w_1=I_2w_2 \quad (or)\, I_1n_1=I_2n_2$

115. Energy conservation $\quad -\frac{GMm}{R}+0=-\frac{3}{2}\frac{GMm}{R}+\frac{1}{2}mV^2$

$V_e=\sqrt{\frac{2Gm}{R}}$ so $V=\frac{V_e}{\sqrt{2}}$

116. $g'=\frac{g}{\left(1+\frac{h}{R}\right)^2}$, $g'=\frac{g}{9}$

$$\frac{g}{9}=\frac{g}{\left(1+\frac{h}{R}\right)^2} \quad \Rightarrow 1+\frac{h}{R}=3 \Rightarrow h=2R$$

117. Heat loss = Heat gain

$m \times 540 + m \times 1 \times (100 - 90) = 22 \times 1(90 - 20) \quad \Rightarrow m = 2.8\,g$

Net mass of water in mixture = 22+2.8 = 24.8 g

118. For mixture of gases

$$\gamma = \frac{n_1 C_{p_1} + n_2 C_{p_2}}{n_1 C_{v_1} + n_2 C_{v_2}}$$

$C_v = \frac{fR}{2}$ where, $C_p = \left(1 + \frac{f}{2}\right) R$

For Helium : $n_1 = 4, f = 3$ For oxygen : $n_2 = \frac{1}{2}, f = 5$

$$\therefore \frac{C_p}{C_v} = \frac{4 \times \frac{5R}{2} + \frac{1}{2} \times \frac{7R}{2}}{4 \times \frac{3R}{2} + \frac{1}{2} \times \frac{5R}{2}} = \frac{47}{29} = 1.62$$

119. $\lambda_1 T_1 = \lambda_2 T_2$

120. $\Delta U = nC_v dT \qquad \Delta Q = \Delta W + \Delta U$

$$\Delta W = \frac{1}{2} \times (2P_0 + P_0) \times V_0 = \frac{3}{2} P_0 V_0$$

$$\frac{PV}{T} = nR \Rightarrow T_1 = \frac{P_0 V_0}{nR}, \; T_2 = \frac{4P_0 V_0}{nR}$$

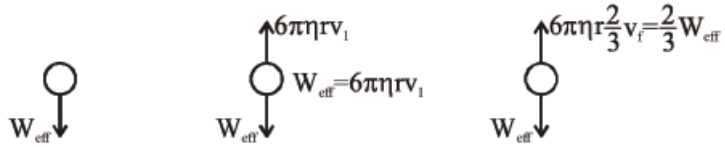
$$\frac{P_0 V_0}{T_0} = \frac{2P_0 2V_0}{T'} \quad \Rightarrow T' = 4T_0$$

Change in temperature = $3T_0$

$$\Delta U = n \times \frac{3}{2} R \times 3T_0 = \frac{9}{2} nRT_0 = \frac{9}{2} P_0 V_0 \qquad \Delta Q = 6\,P_0 V_0$$

121. $\frac{W}{Q_1} = 1 - \frac{T_2}{T_1}$; $\frac{2}{Q_1} = 1 - \frac{200}{300} \Rightarrow Q_1 = 6$

122. $Y = \frac{Stress}{Strain} \Rightarrow Strain = 0.5$



when the ball is released — when the ball attains terminal velocity — When the ball attains 2/3rd of terminal velocity

Figure (1) Figure (2) Figure (3)

123.

When the ball is just released, the net force on ball is W_{eff} (= mg – buoyant force)

The terminal velocity 'v_f' of the ball is attained when net force on the ball is zero.

$\therefore$ Viscous force $6\pi\eta r v_f = W_{eff}$

When the ball acquires $\frac{2}{3} rd$ of its maximum

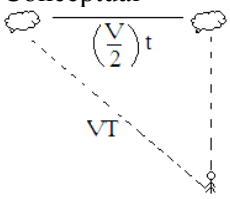
Velocity v_f the viscous force is $= \frac{2}{3} W_{eff}$ Hence net force is $W_{eff} - \frac{2}{3} W_{eff} = \frac{1}{3} W_{eff}$

$\therefore$ Required acceleration is $= \frac{a}{3}$

124. $F = -\dfrac{du}{dx} = -8\cos 2x \simeq -16x$

$a = \dfrac{F}{m} = -\omega^2 x \Rightarrow \omega = 4$

125. Conceptual



126.

$\cos\theta = \dfrac{1}{2}$ $\qquad$ $n^1 = \dfrac{V}{V - V_s\cos\theta} \times n = \dfrac{V}{\left(V - \dfrac{V}{4}\right)} \times n = \dfrac{4}{3} \times n$

127. Conceptual

128. Initially $V = \sqrt{\left(V_C - V_L\right)^2 + {V_R}^2} = 10V$ and $X_L = X_C = R$

Finally $V = \sqrt{{V_R}^2 + {V_C}^2} = \sqrt{2}.V_C \Rightarrow V_C = \dfrac{10}{\sqrt{2}}V$

129. emf in loop $e = -\dfrac{d}{dt}\left(B \times \pi a^2\right) - = \pi a^2 \dfrac{dB}{dt} = 2\pi a^2$

Current $i = \dfrac{e}{R} = \dfrac{2\pi a^2}{R}$ $\qquad$ Power $P = e \times i = \dfrac{4\pi^2 a^4}{R}$

Charge $q = \int_0^2 i\,dt = \int_0^2 \dfrac{2\pi a^2}{R} dt = \dfrac{4\pi a^2}{R}$

130. $\sigma \propto \dfrac{1}{R^2}$

131. $\Delta U = U_f - U_i = k_0\left(\dfrac{Qq}{a+x} + \dfrac{Qq}{a-x} + \dfrac{q^2}{2a} - \dfrac{2Qq}{a} - \dfrac{q^2}{2a}\right)$

$= k_0 Qq\left(\dfrac{a(a-x) + (a+x)a - 2\left(a^2 - x^2\right)}{\left(a^2 - x^2\right)a}\right) = k_0 Qq\left(\dfrac{2x^2}{a\left(a^2 - x^2\right)}\right)$

Since 'x' is small, $a^2 - x^2 = a^2$

$\Delta U = k_0 Qq\left(\dfrac{2x^2}{a^3}\right)$

132. $\dfrac{E}{B} = C$

133. $F = \dfrac{q^2}{2\varepsilon_0 A}$, when capacitor is isolated

134. $B = \dfrac{\mu_0 i}{2\pi r} \Rightarrow B \propto \dfrac{1}{r}$

135. Acceleration is perpendicular to B

$\vec{a}.\vec{B} = 2x + 3 - 4 = 0 \Rightarrow x = \dfrac{1}{2}$