



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. The following is the defining feature of living organisms

- (1) Consciousness
- (2) Metabolism
- (3) Cellular organization of body
- (4) More than one option is correct

02. Completely heterotrophic unicellular eukaryotic organisms belong to

- A) Slime moulds
- B) Chrysophytes
- C) Protozoans
- D) Euglenoids
- E) Dinoflagellates

- (1) A, D, C
- (2) A, C
- (3) A, E, D
- (4) B, D, E

03. 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

04. 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

05. Identify the mismatch

(1) <i>Rhizopus</i>	Aseptate mycelium	Endogenous sporangiospores
(2) <i>Neurospora</i>	Septate mycelium	Ascospores
(3) <i>Agaricus</i>	Septate mycelium	Basidiocarp
(4) <i>Alternaria</i>	Aseptate mycelium	Exogenous conidia

06. Cryopreservation of gametes of Threatened Species is:

- (1) also referred to as seed banking
- (2) an *in-situ* conservation of germ cell lines
- (3) an advanced *ex-situ* conservation of biodiversity
- (4) an *in-situ* conservation of animal genetic resources

07. Identify the incorrect statement

- (1) *Chara* has monoecious gametophyte
- (2) *Marchantia* has monoecious gametophyte
- (3) *Funaria* has monoecious gametophyte
- (4) *Selaginella* has dioecious gametophyte

08. 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

09. Study the diagram and identify the type of placentation.



- (1) Free central
- (2) Axile
- (3) Parietal
- (4) Basal

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. The ratio between sporophylls and non-sporophylls of the flower is 3 : 2 in

- (1) *Pisum*
- (2) *Allium*
- (3) *Makoi*

(4) *Muliathi*

12. 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

13. Identify the correct statement regarding collateral vascular bundle.

- A) Xylem and phloem lie on the same radius
- B) Phloem lies towards centre and xylem lies towards periphery
- C) Phloem lies only one side to xylem
- D) Phloem lies towards periphery and xylem lies towards centre

- (1) A, C, D
- (2) A, B
- (3) C, D
- (4) B

14. Unrelated to bulliform cells is

- (1) Commonly found in grass leaves
- (2) Found in abaxial epidermis of the leaf
- (3) Hygroscopic in nature
- (4) Large, empty and colourless cells

15. Identify the mismatch

- (1) Linus Pauling – publication of α -helix and β -sheet structures of proteins
- (2) G.N. Ramachandran – Triple helical structure of collagen
- (3) Schleiden and Schwann – Cell theory
- (4) R. Virchow – Mutation theory

16. 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

17. 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

18. 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 → III → I
- (2) I → II → III
- (3) II → I → III
- (4) III → II → I

19. The following is not a function of cell membrane

- (1) Transport of molecules
- (2) Cell growth
- (3) Endocytosis

(4) Protein folding

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 in accumulation of superior genes
- (4) exposes harmful recessive genes that are eliminated by selection

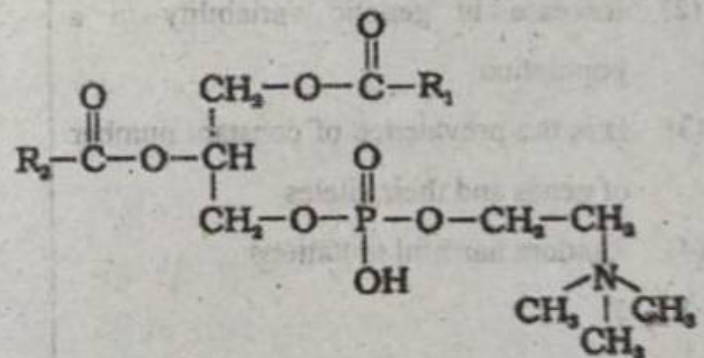
21. Mitochondria and chloroplasts differ from each other with respect to

- (1) Synthesis of sugar and ATP
- (2) Double membrane envelope
- (3) Circular naked DNA and 70s Ribosomes
- (4) Semiautonomous nature

22. HIV targets include all of the following except:

- (1) Helper T – cells
- (2) Macrophages
- (3) Cells bearing CD4
- (4) Cytotoxic T- cells

23. Identify the related option regarding given diagram



- (1) Lecithin
- (2) Cholesterol
- (3) Glycerol
- (4) Fatty acid

24. 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

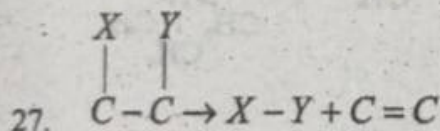
25. Statement-I : Glut-4 regulates glucose concentration in the blood.

Statement-II : Insulin is a protein, which enables glucose transport into cells.

- (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

26. Which of the following is correct for Genetic Bottle Neck effect?

- (1) Decrease in genetic variability in a population
- (2) Increase in genetic variability in a population
- (3) It is the prevalence of constant number of genes and their alleles
- (4) Random harmful mutations



Enzyme which catalyses the above reaction belongs to the following class

- (1) 2

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

28. 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

29. Centriole duplication occurs during this phase

- (1) S
- (2) Prophase
- (3) Metaphase
- (4) Anaphase

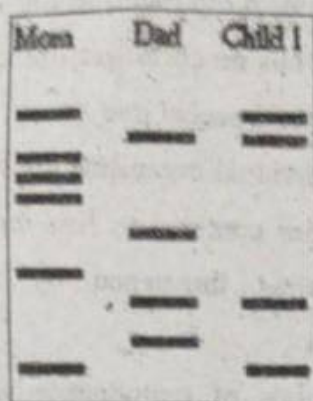
30. Identify the correct matching

List-I		List-II		
A) Zygotene	I) Formation of Synaptonemal complex			
B) Diakinesis	II) Dissolution of Synaptonemal complex			
C) Diplotene	III) Transition to metaphase-I			
D) Pachytene	IV) Recombinase			
	A	B	C	D
(1)	III	I	II	IV
(2)	I	III	IV	II
(3)	I	III	II	IV
(4)	I	II	III	IV

31. Find out the incorrect one

- (1) Pure water $\psi_w = 0$
- (2) Flaccid cell $\psi_p = 0$
- (3) Fully turgid cell = Osmotic pressure is 'zero'
- (4) Pure water $\psi_\pi = 0$

32. What is the relationship between the child-I and parents?



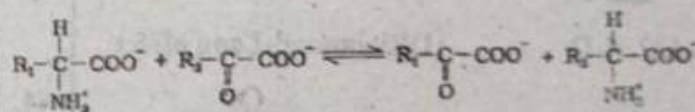
- (1) Biological to only mom
 - (2) Biological to only dad
 - (3) Biological to both
 - (4) Biological to neither
33. A widely accepted method of contraception in India is
- (1) IUDs
 - (2) Diaphragms
 - (3) Tubectomy
 - (4) Cervical caps
34. Correct statement *w.r.t.* Medical termination of pregnancy 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.

35. Statement-I : Ability to resist to a pulling force is called capillarity.
Statement-II : Ability to rise in thin tubes is called tensile strength.

- (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

36. Identify the type of reaction



- (1) Reductive amination
 - (2) Catalytic amination
 - (3) Transamination
 - (4) Decarboxylation
37. Which of the following produces the male sex hormone?
- (1) Rete testis
 - (2) Seminiferous tubule
 - (3) Leydig cell
 - (4) Scrotum
38. If the menstrual cycle is of 32 days, then ovulation would occur on the:
- (1) 14th day
 - (2) 18th day
 - (3) 28th day
 - (4) 5th day

39. Identify the correct regarding C_4 cycle
- (1) Decarboxylation occurs in agranal chloroplast
 - (2) Primary carboxylation occurs in cytosol of mesophyll cell
 - (3) Reduction of OAA occurs in granal chloroplast
 - (4) More than one option is correct
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. Identify the correct matching
- | | | | |
|-------------|--|--------------------------------------------------|--|
| List-I | | List-II | |
| A) 2, 4-D | | D) Richmond-Lang effect | |
| B) GA_3 | | II) Promotes $\frac{Q}{+}$ flowers in Cucumbers. | |
| C) Zeatin | | III) Speedup malting process in Breweries | |
| D) C_2H_4 | | IV) Selective herbicide | |
- | | | | | |
|-----|-----|-----|----|----|
| | A | B | C | D |
| (1) | IV | III | II | I |
| (2) | IV | III | I | II |
| (3) | III | IV | I | II |
| (4) | III | IV | II | I |
42. 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
43. Identify the incorrect statement
- (1) The period from birth to natural death of an organism represents its life span
 - (2) A mango has much longer life span as compared to a peepal tree
 - (3) While individual organisms die without fail, species continue to live for many years unless threatened by natural extinction
 - (4) Sexual mode of reproduction enables creation of new variants
44. Asexual spores produced in fungi are
- (1) Oospore, Zygospor
 - (2) Conidia, Zoospore
 - (3) Zygospor, Aplanospore
 - (4) Conidia, Oospore
45. 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
46. 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

47. Polyembryony is found in
- (1) *Citrus*
 - (2) Mango
 - (3) *Cycas*
 - (4) More than one option is correct
48. 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
49. Apocarpus gynoecium is present in
- (1) *Hibiscus*
 - (2) *Papaver*
 - (3) *Michelia*
 - (4) *Datura*
50. Which part of the brain is first affected after consuming alcoholic beverages?
- (1) Cerebrum
 - (2) Olfactory lobe
 - (3) Cerebellum
 - (4) Medulla oblongata
51. Pre-fertilized nutritive tissue nourishes the product of fertilization during its development in
- (1) *Cocos*
 - (2) *Oryza*
 - (3) *Cycas*
 - (4) *Solanum*
52. Calculation, contemplation and cognition are human activities associated with increased activity in the:
- (1) Cerebrum
 - (2) Cerebellum
 - (3) Spinal cord
 - (4) Pituitary gland
53. Dicliny in a monoecious plant
- (1) Prevents autogamy and geitonogamy
 - (2) Prevents geitonogamy and xenogamy
 - (3) Prevents xenogamy but not autogamy
 - (4) Prevents autogamy but not geitonogamy
54. 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
55. One of the following option gives dihybrid F_2 genotype ratio
- (1) (1 : 2 : 1) (3 : 1)
 - (2) (3 : 1) (1 : 2 : 4)
 - (3) (1 : 1) (1 : 2 : 1)
 - (4) (1 : 2 : 1) (1 : 2 : 1)
56. The most freely movable joint of all synovial joints is:
- (1) Ball and socket joint
 - (2) Hinge joint
 - (3) Pivot joint
 - (4) Gliding joint

57. Identify the incorrect statement regarding A, B, O blood grouping
- (1) I^A, I^B are completely dominant over i
 - (2) If I^A, I^B are present the phenotype is AB blood group
 - (3) If $I^B i$ are present it is O blood group
 - (4) If $I^A i$ are present it is A blood group
58. Motor neurons electrically stimulate nearby muscle fibres at _____
- (1) Creatine phosphate
 - (2) Actin filament
 - (3) Neuromuscular junction
 - (4) Cross-bridges
59. During phosphodiester bond formation incoming nucleotide reacts with
- (1) $5' - (P)$ of preceding nucleotide
 - (2) $3' - OH$ of succeeding nucleotide
 - (3) $2' - OH$ of succeeding nucleotide
 - (4) $3' - OH$ of preceding nucleotide
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. In eukaryotes RNA polymerase II, transcribes
- (1) SnRNA, 5.8 srRNA
 - (2) mRNA, rRNA
 - (3) hnRNA
 - (4) tRNA, SnRNA
62. Statement-I : The UTRs are present before start codon and after stop codon on mRNA.
Statement-II : At the end of translation the release factor (RF) binds to larger sub unit of ribosome for chain termination.
- (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
63. In negative regulation of Lac operon, repressor binds to
- (1) i - gene
 - (2) z - gene
 - (3) o - gene
 - (4) y - gene
64. 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
65. 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

66. Which of the following is devoid of muscle layer?
- (1) Capillaries
 - (2) Arterioles
 - (3) Veins
 - (4) Arteries
67. Identify the incorrect statement
- (1) Microbes are not involved during primary treatment of sewage.
 - (2) Flocs are anaerobes
 - (3) The greater the BOD of waste water, more is its polluting potential
 - (4) During secondary treatment, flocs are allowed to sediment and is called activated sludge.
68. Bioactive molecule that suppresses host immune system in organ transplanted patients is
- (1) Statins
 - (2) Streptokinase
 - (3) Cyclosporin-A
 - (4) Concanavalin
69. Among the following cells that are not directly involved in inflammatory reactions are:
- (1) Macrophages
 - (2) Neutrophils
 - (3) Monocytes
 - (4) Thrombocytes
70. Which of the following granulocytes arrive at the earliest at the site of infection?
- (1) Eosinophils
 - (2) Basophils
 - (3) Neutrophils
 - (4) Monocytes
71. Identify the correct statement

- (1) HD 1553 is a wheat variety
- (2) P1542 is a *Pisum* variety
- (3) Jaya and Ratna are semi dwarf high yielding varieties of rice
- (4) All the above

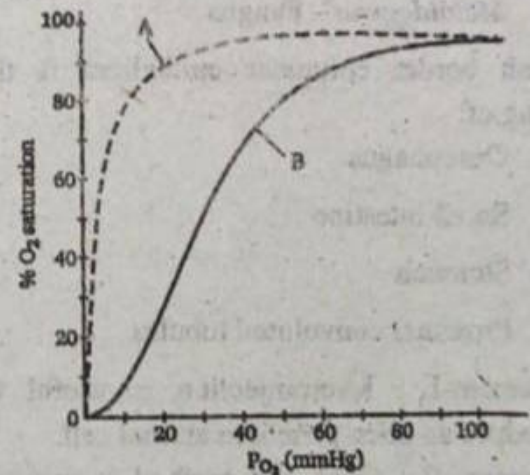
72. Pusa gaurav is a variety of

- (1) Cow pea
- (2) Chilli
- (3) Bhindi
- (4) Rapeseed

73. 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

74. Which of the following is true for the curves A and B shown in the dissociation curve below?



- (1) A represents the dissociation curve for haemoglobin
- (2) B represents the dissociation curve for myoglobin
- (3) Curve A in comparison to curve B shows that myoglobin has more affinity for oxygen than haemoglobin
- (4) Curve B in comparison to curve A shows that haemoglobin has more affinity for oxygen than myoglobin

75. Unrelated to pBR322

- (1) It contains amp^R and tet^R genes
- (2) Pvu I cloning site is present on rop region
- (3) rop codes for the proteins involved in the replication of the plasmid
- (4) Bam HI site is found on tetracycline resistant gene

76. 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

77. Identify the mismatch

- (1) Cry IAb – Corn borer
- (2) Cry IIAb – Cotton boll worm
- (3) Golden rice – Vitamin A
- (4) *Meloidegyne* – Fungus

78. Brush border columnar epithelium is the lining of:

- (1) Oesophagus
- (2) Small intestine
- (3) Stomach
- (4) Proximal convoluted tubules

79. Statement-I : Microinjection is useful to introduce an alien gene into animal cell.
Statement-II : Gene gun method is suitable for plant cells to introduce a foreign gene.

- (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

80. Match the following :

List-I	List-II
A) Adenovirus	i) Butyric acid
B) <i>Clostridium butylicum</i>	ii) Citric acid
C) <i>Aspergillus niger</i>	iii) Respiratory infections
D) <i>Acetobacter aceti</i>	iv) Acetic acid

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

81. 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

82. 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

83. One of the following cannot be used as explant

- (1) Parenchyma cell
- (2) Collenchyma cell
- (3) Meristematic cell
- (4) Mature sieve tube element

84. 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)

85. Which of the following is the logical sequence of carbon cycle ?

(1) Photosynthesis → Decomposer → Consumer

(2) Photosynthesis → Consumer → Decomposer

(3) Decomposer → Photosynthesis → Consumer

(4) Consumer → Photosynthesis → Consumer

86. 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*

87. Each trophic level has a certain mass of living material at a particular time called

(1) Standing state

(2) Standing crop

(3) Secondary productivity

(4) Gross primary productivity

88. Read the following statements w.r.t. mollusca:

i) Eyes of some cephalopods are analogous to the vertebrate eyes

ii) Haemoglobin remains dissolved in blood plasma

iii) Most of them possess open circulatory system

iv) Blood has haemocyanin as respiratory pigments

v) Exoskeleton is usually absent

Which of the above statements are correct?

(1) (ii), (v)

(2) (i), (iii), (iv)

(3) (ii), (iii), (v)

(4) (iv), (v)

89. Statement-I : NADH is oxidized to NAD^+ rather slowly in fermentation, however the reaction is very vigorous in case of aerobic respiration.

Statement-II : Glucose is the favoured substrate for respiration.

(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

90. *Meandrina* is:

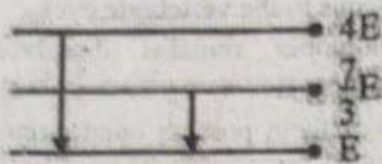
(1) the Brain coral

(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



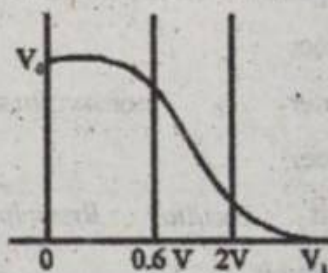
- (1) $\frac{9}{4}$
 (2) $\frac{4}{9}$
 (3) $\frac{3}{2}$
 (4) $\frac{7}{3}$
92. All electron ejected from a surface by incident of wavelength 200 nm can be stopped before travelling 1 meter in the direction of a uniform electric field of 4 NC^{-1} the work function of the surface is .
 (1) 4 eV
 (2) 5.2 eV
 (3) 3 eV
 (4) 2.2 eV
93. The de Broglie wavelength of an electron moving with a velocity $1.5 \times 10^8 \text{ m/s}$ 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. M_x and M_y denote the atomic masses of the parent and the daughter nuclei respectively in a radioactive decay. The Q -value for a β^- decay is Q_1 and that for a β^+ decay is Q_2 . If m_e denotes the mass of an electron, then which of the following statements is correct?

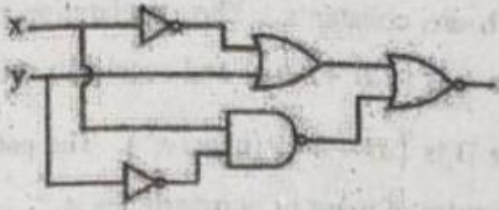
- (1) $Q_1 = (M_x - M_y)c^2$ and
 $Q_2 = (M_x - M_y - 2m_e)c^2$
 (2) $Q_1 = (M_x - M_y)c^2$ and
 $Q_2 = (M_x - M_y)c^2$
 (3) $Q_1 = (M_x - M_y - 2m_e)c^2$ and
 $Q_2 = (M_x - M_y + 2m_e)c^2$
 (4) $Q_1 = (M_x - M_y + 2m_e)c^2$ and
 $Q_2 = (M_x - M_y + 2m_e)c^2$

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



- (1) At $V_i = 1 \text{ V}$, it can be used as an amplifier
 (2) At $V_i = 0.5 \text{ V}$, it can be used as a switch turned off.
 (3) At $V_i = 2.5 \text{ V}$, it can be used as a switch turned on
 (4) At $V_i = 0.4 \text{ V}$, transistor is in active state

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



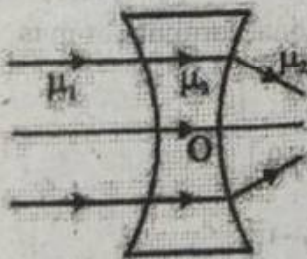
- (1) $x = 0, y = 1$
 (2) $x = 1, y = 1$
 (3) $x = 1, y = 0$
 (4) $x = 0, y = 0$

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 field in the depletion region if the doping concentration is small
 (d) strong electric field 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



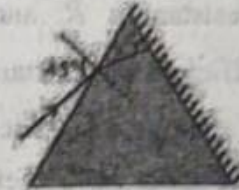
- (1) $\mu_1 < \mu_2 < \mu_3$

(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° is coated with silver. A ray incident on another face at an angle of 45° 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 placed 50 cm from a single slit, which is illuminated with 6000 Å 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) $\frac{\sqrt{R_1 R_2 \alpha_1 \alpha_2}}{\sqrt{R_1^2 + R_2^2}}$

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

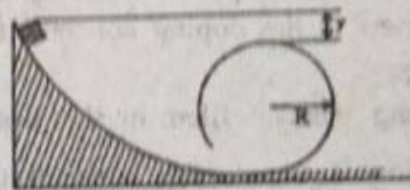
105. If a number of forces act on a body and the body is in static or dynamic equilibrium, then

- (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 $(2a\hat{i} + 4b\hat{i})$ and acceleration of particle B is $(a\hat{i} - b\hat{i})$ (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

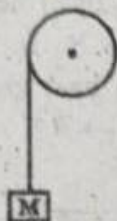
of segments in which the string is divided, F is the tension in the string and l is its length. The dimensional formula for m is

- (1) $[M^0 L^0 T^0]$
- (2) $[ML^{-1} T^0]$
- (3) $[ML^0 T^{-1}]$
- (4) $[M^0 L T^{-1}]$

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 $0.32 \text{ kg}\cdot\text{m}^2$ 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 $g = 10 \text{ m/s}^2$)



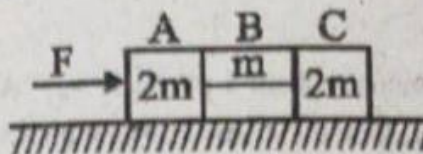
- (1) 1 m/s^2
- (2) 3 m/s^2
- (3) 2 m/s^2
- (4) 4 m/s^2

111. A particle thrown at an angle of 30° 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° 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) $R_1 = \frac{R_2}{3}; H_1 = H_2$

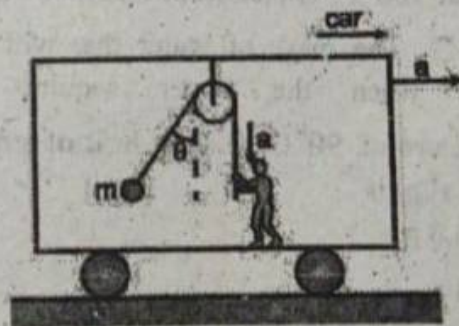
(4) $R_1 = 3R_2; H_1 = H_2$

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) $m(g + a)$

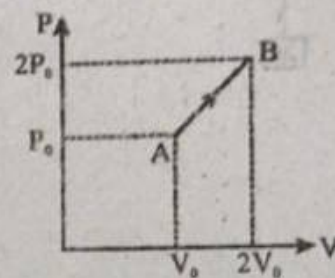
114. A ballet dancer spins about a vertical axis at 60 rpm with his arms closed. Now he stretches his arms such that M.I increases by 50%. The new speed of spin would be
- (1) 80 rpm
 - (2) 40 rpm
 - (3) 90 rpm
 - (4) 30 rpm
115. The escape velocity from a planet is v_e . A tunnel is dug along the diameter 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 $1/9^{\text{th}}$ its weight on the surface of earth (radius of earth is R)
- (1) $h = 3R$
 - (2) $h = R$
 - (3) $h = \frac{R}{2}$
 - (4) $h = 2R$
117. Steam at 100°C is passed into 22g of water at 20°C . The mass of water that will be present when the water acquires a temperature of 90°C (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 16g of helium and 16 g of oxygen. The ratio (C_p/C_v) 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 2000K. 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 $A \rightarrow B$ is shown in the figure. What is the heat given to the gas during the process $A \rightarrow B$?



- (1) $4P_0V_0$
 - (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. A cylindrical wire of length L and cross section area A having weight W is hanged as shown in figure.

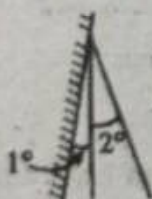


If Young's modulus is Y , strain energy in wire due to its own weight will be

- (1) $\frac{W^2 L}{2AY}$
 (2) $\frac{W^2 L}{3AY}$
 (3) $\frac{W^2 L}{6AY}$
 (4) $\frac{W^2 L}{AY}$
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) $\frac{a}{3}$
 (2) $\frac{2a}{3}$
 (3) $\frac{a}{6}$
 (4) $\frac{2a}{5}$

124. A simple pendulum of length 1 m is allowed to oscillate with amplitude 2° . It collides elastically with a wall inclined at 1° to the vertical. Its time period will be (use $g = \pi^2$)



- (1) $\frac{2}{3}$ sec

- (2) $\frac{4}{3}$ sec
 (3) 2 sec
 (4) $\frac{5}{3}$ sec

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

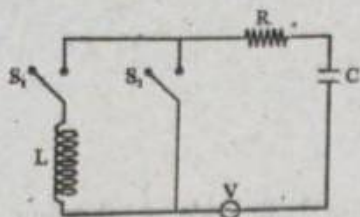
- (1) zero everywhere
 (2) dependent on the location along the string
 (3) non zero everywhere
 (4) non zero and in the same direction everywhere

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



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 is opened and S_2 is closed?

- (1) 10
- (2) $10\sqrt{2}$
- (3) $\frac{10}{\sqrt{2}}$
- (4) $15\sqrt{2}$

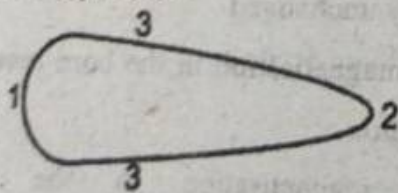
129. A conducting circular loop of radius a and resistance R is kept on horizontal plane. A vertical time varying magnetic field $B = 2t$ is switched on at time $t = 0$. Then

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

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

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

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

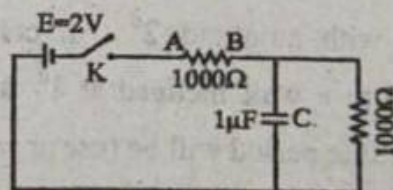
131. Two equal point charges q are fixed at $x = -a$ and $x = +a$ on x -axis. Another point charge Q is placed at the origin. The change in electrical potential energy of Q , when it is displaced by a small amount x along x -axis, is approximately proportional to

- (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 $9 \times 10^{-4} \text{ NC}^{-1}$. Then, the average magnetic field in the same region is of the order of

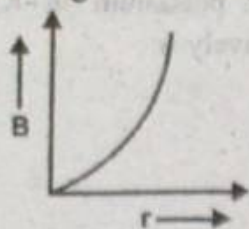
- (1) $27 \times 10^{-4} T$
- (2) $3 \times 10^{-12} T$
- (3) $\left(\frac{1}{3} \right) \times 10^{-12} T$
- (4) $3 \times 10^{12} T$

133. When the key K is pressed at time $t = 0$, then which of the following statements about the current I in resistor AB of the given circuit is true?

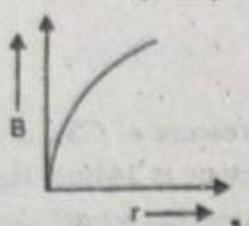


- (1) $I = 1 \text{ mA}$ at all times
- (2) $I = 2 \text{ mA}$ at all times
- (3) I oscillates between 1 mA and 2 mA
- (4) At $t = 0, I = 2 \text{ mA}$ and it becomes 1 mA with time

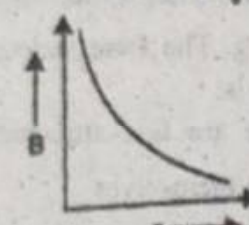
134. The graph showing the variation of the magnetic field strength (B) with distance (r) from a long current carrying conductor is



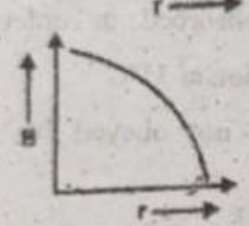
(1)



(2)

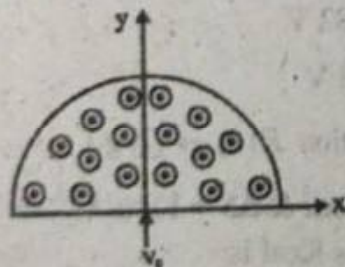


(3)



(4)

135. Magnetic field given by $(100\hat{k})T$ in the region defined by $x^2 + y^2 = 16m^2$ and $y > 0$. A charge particle of mass $m = 10^{-19} kg$, $q = 1.6 \times 10^{-19} C$, enters at origin with a velocity $(640\hat{j})m/s$. What is the angle of deviation suffered by charge particle in the magnetic field



(1) 60°

(2) 30°

(3) 90°

(4) 180°

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. Addition of 2.0×10^{-2} moles of a strong acid to half litre of an acidic buffer changes its pH by 0.01 only. The buffer capacity of the buffer is:

(1) 0.005

(2) 0.55

(3) 4

(4) 2.5

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 $2.5 \times 10^5 \text{ sec}^{-1}$?

(1) $5.0 \times 10^5 \text{ sec}^{-1}$

(2) $1.0 \times 10^5 \text{ sec}^{-1}$

(3) $3.0 \times 10^6 \text{ sec}^{-1}$

(4) $2.5 \times 10^5 \text{ sec}^{-1}$

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 of $Pb(OH)_2$ in water is 6×10^{-6} M. The solubility of $Pb(OH)_2$ in a buffer solution of $pH = 10$ is

- (1) 3.5×10^{-10} M
- (2) 8.6×10^{-8} M
- (3) 2.2×10^{-6} M
- (4) 1.8×10^{-2} M

144. $Pb_3O_4 + 8HCl \longrightarrow 3PbCl_2 + Cl_2 + 4H_2O$.

In this reaction, the number of moles of HCl reacting with PbO are

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

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. At $35^\circ C$, the vapour pressure of CS_2 is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

- (1) CS_2 and acetone are less attracted to each other than to themselves
- (2) heat must be absorbed in order to produce the solution at $35^\circ C$
- (3) Raoult's law is not obeyed by this system
- (4) a mixture of 200 mL CS_2 and 200 mL acetone has a volume of < 400 mL

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 $P(l) \rightarrow Q(g)$

$\Delta U = 2.1 \text{ Kcal}$ & $\Delta S = 15 \text{ calK}^{-1}$ 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

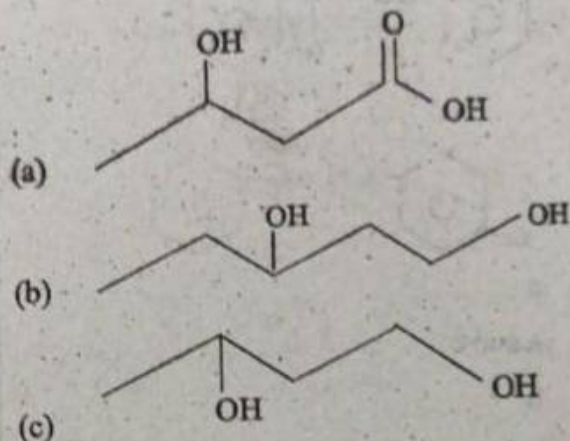
(3) Drugs which compete with natural substrate on active site are called competitive inhibitors

(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. A polymer X is used in the controlled release of drugs. 'X' on hydrolysis give 'Y' and 'Z', these on reaction with LiAlH_4 gives



- (1) Both a and b
- (2) Both a and c
- (3) Both b and c
- (4) All of these

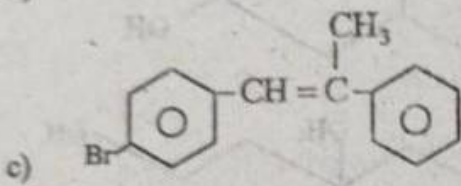
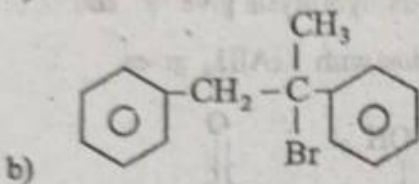
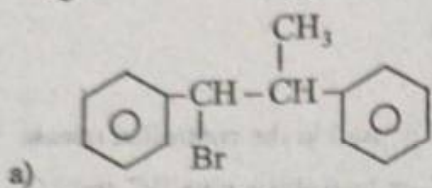
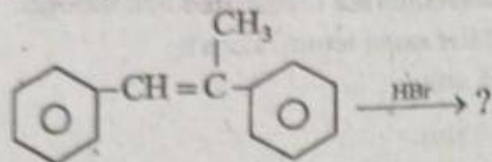
156. In a sample of FeO , when 12 Fe^{+2} ions are replaced with electrically balanced number of Fe^{+3} ions, then the composition of FeO is:

- (1) $\text{Fe}_{0.88}\text{O}$
- (2) $\text{Fe}_{0.96}\text{O}$
- (3) $\text{Fe}_{0.82}\text{O}$
- (4) $\text{Fe}_{0.79}\text{O}$

157. A disaccharide consisting of two α -D-glucose units in which C₁ of one glucose is linked to C₄ of another α -D-glucose unit is:

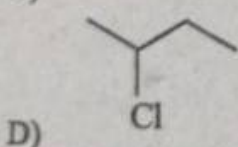
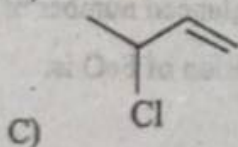
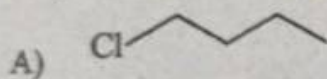
- (1) Maltose
- (2) Sucrose
- (3) Lactose
- (4) Celulose

158. Which of the following is/are the major product(s) of the following reaction?



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

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



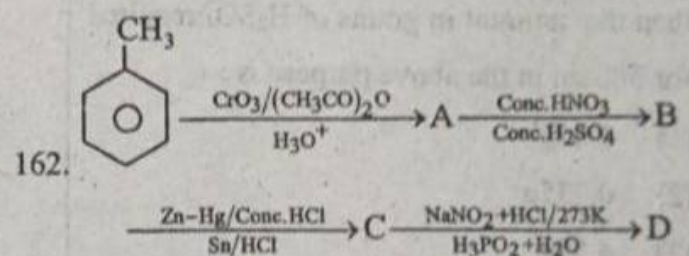
- (1) C > B > D > A
- (2) C > D > B > A
- (3) B > C > D > A
- (4) A > B > C > D

160. Oil of Mirabane on reduction with LiAlH_4 gives orange red dye (Azobenzene). In this reaction, the equivalent weight of nitrobenzene is [M = Molecular weight]

- (1) $\frac{M}{6}$
- (2) $\frac{M}{4}$
- (3) $\frac{M}{2}$
- (4) $\frac{M}{1}$

161. Number of S - O bond in $\text{S}_2\text{O}_8^{2-}$ and number of S - S bond in rhombic sulphur are respectively

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



IUPAC name of 'D' is

- (1) 3 - hydroxyl benzaldehyde
- (2) Benzene carbaldehyde
- (3) Methyl benzene
- (4) Benzene 1, 3 diol

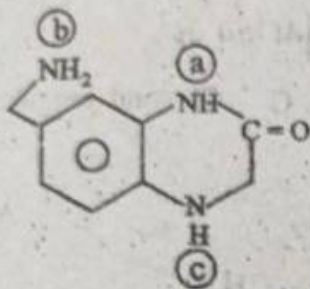
163. Incorrect combination among hydrides of Halogens is

- (1) Acidic nature : $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
- (2) Reducing nature : $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$
- (3) Boiling points : $\text{HF} > \text{HI} > \text{HBr} > \text{HCl}$
- (4) Volatility : $\text{HCl} > \text{HBr} > \text{HI} > \text{HF}$

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

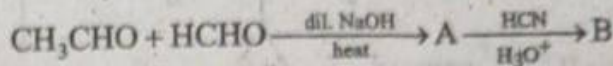
- (1) 20%
- (2) 10%
- (3) 40%
- (4) 5%

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

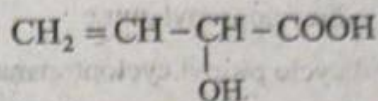
- (1) I and II are true
- (2) I and II are false
- (3) I is true, II is false
- (4) I is false, II is true

168.

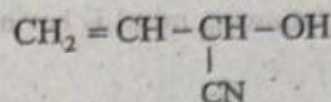


'B' is

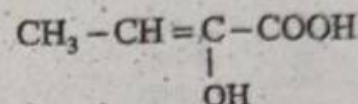
(1)



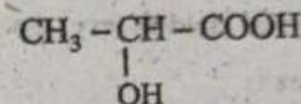
(2)



(3)



(4)



169. Number of carboxylic acids and esters (structural only) possible with the formula $\text{C}_4\text{H}_8\text{O}_2$ are

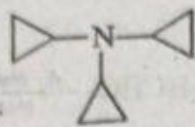
- (1) 6
- (2) 4
- (3) 5
- (4) 3

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

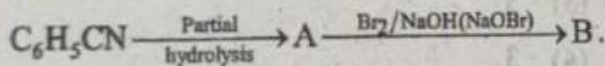
173. Which of the following metal is having least melting point ?

- (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.



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

- (1) CH_3COOH
- (2) CH_3COCl
- (3) $(\text{CH}_3\text{CO})_2\text{O}$
- (4) $\text{CH}_3\text{COOC}_2\text{H}_5$

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

- (1) $\text{Br} < \text{Cl} < \text{C} < \text{O} < \text{F}$
- (2) $\text{Br} > \text{Cl} > \text{C} > \text{O} > \text{F}$
- (3) $\text{Cl} < \text{C} < \text{O} < \text{F} < \text{Br}$
- (4) $\text{C} > \text{F} > \text{O} > \text{Br} > \text{Cl}$

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

- (1) $[\text{Xe}]4f^7, [\text{Xe}]4f^1$
- (2) $[\text{Xe}]4f^7 6s^2, [\text{Xe}]4f^1$
- (3) $[\text{Xe}]4f^7 6s^2, [\text{Xe}]4f^1 5d^1 6s^2$
- (4) $[\text{Xe}]4f^7, [\text{Xe}]4f^1 5d^1 6s^2$

178. In which compound C - Cl bond length is shortest ?

- (1) $\text{Cl}-\text{CH}=\text{CH}_2$
- (2) $\text{Cl}-\text{CH}=\text{CH}-\text{CH}_3$
- (3) $\text{Cl}-\text{CH}=\text{CH}_2-\text{CH}_2-\text{CH}_3$
- (4) $\text{Cl}-\text{CH}=\text{CH}-\text{NO}_2$

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

BOT : 1, 2, 5, 7, 9, 11, 13, 14, 15, 19, 21, 23, 25, 27, 29, 30, 31, 35, 36, 39, 41, 43, 44, 47, 49, 51, 53, 55, 57, 59, 61, 62, 63, 67, 68, 71, 72, 75, 77, 79, 80, 83, 85, 87, 89

ZOO : 3, 4, 6, 8, 10, 12, 16, 17, 18, 20, 22, 24, 26, 28, 32, 33, 34, 37, 38, 40, 42, 45, 46, 48, 50, 52, 54, 56, 58, 60, 64, 65, 66, 69, 70, 73, 74, 76, 78, 81, 82, 84, 86, 88, 90

BIOLOGY

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

PHYSICS

91) 2	92) 4	93) 1	94) 1	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) 2
121) 4	122) 3	123) 1	124) 2	125) 2	126) 4	127) 1	128) 3	129) 4	130) 4
131) 2	132) 2	133) 4	134) 3	135) 1					

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) 3	159) 1	160) 2	161) 1	162) 3	163) 1	164) 3	165) 3
166) 2	167) 1	168) 1	169) 1	170) 4	171) 4	172) 3	173) 4	174) 2	175) 1
176) 2	177) 1	178) 4	179) 4	180) 2					

PHYSICS SOLUTIONS

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

KE of electron = $eV = e(E \times d) = e(4 \times 1) = 4 \text{ eV}$

Work function = $E - W = 2.2 \text{ eV}$

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

$$\frac{E_e}{E_{ph}} = \frac{\frac{1}{2} m_e v_e^2}{\frac{hc}{\lambda_p}} \quad \left(\because \lambda_e = \frac{h}{m_e v_e} \right)$$

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

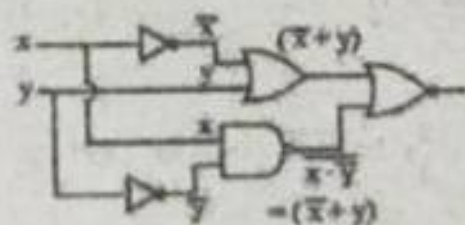
94. During positive β - decay ${}_Z M^A \rightarrow {}_{Z-1} M^A + {}_{+1} e^0 + Q_2$

$$Q_2 = [(M_z)_n + (M_{z-1})_n - m_e] C^2 = [(M_z - z m_e) - (M_y - (z-1) m_e) - m_e] C^2 = [M_z - M_y - 2m_e] C^2$$

(\because Atomic mass - mass of electrons = Nuclear mass)

Similarly during β^- decay ${}_Z M^A \rightarrow {}_{Z-1} M^A + {}_{-1} e^0 + Q_1$

95. Conceptual



96.

$$R = (\overline{x+y}) + (\overline{x+y}) = \overline{x+y} = x \cdot \overline{y}$$

$$R = x \cdot \overline{y} \text{ for } R=1 \Rightarrow x=1 \text{ \& } y=0$$

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 $\mu_1 = \mu_3$

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

Since, $r_1 + r_2 = R \therefore r_1 = R = 30^\circ$

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

100. $\frac{f_0}{f_c} = 100; \quad f_0 = 100 f_c$

$f_0 + f_c = 101 \Rightarrow 100 f_c + f_c = 101; f_c = 1 \text{ cm}, f_0 = 100 \text{ cm}$

101. Conceptual

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

$(y_2 - y_1) = (3-1)\lambda \left(\frac{D}{a}\right) = 3 \text{ mm} \quad a = 0.2 \text{ mm}$

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

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

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

$i = \left(\frac{E}{R+R_1}\right) \frac{R}{L} \Rightarrow \frac{5 \times 10^{-3}}{10^{-2}} = \left(\frac{4}{R+6}\right) \frac{6}{4} \Rightarrow R = 6 \Omega$

105. Conceptual

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

$\vec{a}_{\text{cm}} = \frac{m_1 a_1 + m_2 a_2}{m_1 + m_2} = \frac{a_1 + a_2}{2} = \frac{3}{2}(a\hat{i} + b\hat{j})$

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

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

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

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

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

109. $u = 6.25 \text{ m/s}$

$\frac{dv}{dt} = \frac{5}{2}\sqrt{v} \Rightarrow \frac{dv}{\sqrt{v}} = \frac{5}{2} dt \Rightarrow \int_0^v \frac{dv}{\sqrt{v}} = \frac{5}{2} \int_0^t dt \Rightarrow \left[\frac{2\sqrt{v}}{1/2}\right]_0^v = \frac{5}{2} t \Rightarrow \sqrt{6.25} - 0 = \frac{5}{4} \times t \Rightarrow t = 2 \text{ s}$

110. $Mg - T = Ma$ for motion of M

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

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

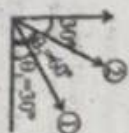
From $Mg - T = Ma \Rightarrow 20 - 8a = 2a \Rightarrow a = 2 \text{ m/s}^2$

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

$\therefore \theta = 30^\circ$ and $\theta = 90^\circ - 30^\circ = 30^\circ$

Thus $R_1 = R_2$

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

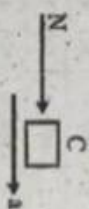


$\therefore \frac{H_1}{H_2} = \frac{\sin^2 30^\circ}{\sin^2 60^\circ} = \frac{\left(\frac{1}{2}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2} = \frac{1}{3} \Rightarrow H_1 = \frac{H_2}{3}$

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

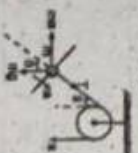
Let N be the normal reaction between B and C

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

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



113. (Force diagram in the frame of the cart)

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

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

114. $I_1 \omega_1 = I_2 \omega_2$ (or) $I_1 \omega_1 = I_2 \omega_2$

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

$v = \sqrt{\frac{3GM}{R}}$ so $v = \sqrt{\frac{3}{2}}$

$$116. E' = \frac{E}{1 + \frac{A}{R}}, E'' = \frac{E}{9}$$

$$\frac{E}{9} = \frac{E}{1 + \frac{A}{R}} \Rightarrow 1 + \frac{A}{R} = 3 \Rightarrow A = 2R$$

117. Heat loss = Heat gain

$$m \times 540 + m \times 1 \times (100 - 90) = 22 \times 1(90 - 20) \Rightarrow m = 2.8 \text{ g}$$

Net mass of water in mixture = $22 + 2.8 = 24.8 \text{ g}$

118. For mixture of gases

$$Y = \frac{n_1 C_{V1} + n_2 C_{V2}}{n_1 C_{V1} + n_2 C_{V2}}$$

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

For Helium: $n_1 = 4, f = 3$

For oxygen: $n_2 = \frac{1}{2}, f = 5$

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

119. $\lambda_1 T_1 = \lambda_2 T_2$

120. $\Delta U = n C_V \Delta T$ $\Delta Q = \Delta W + \Delta U$

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

$$\frac{P V}{T} = n R \Rightarrow T_1 = \frac{P_0 V_0}{n R}, T_2 = \frac{4 P_0 V_0}{n R}$$

$$\frac{P_0 V_0}{T_0} = \frac{2 P_0 V_0}{T} \Rightarrow T = 2 T_0$$

Change in temperature = $3 T_0$

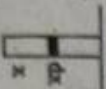
$$\Delta U = n \times \frac{3}{2} R \times 3 T_0 = \frac{9}{2} n R T_0 = \frac{9}{2} P_0 V_0$$

$$\Delta Q = 6 P_0 V_0$$

$$121. \frac{W}{Q_1} = 1 - \frac{T_2}{T_1}$$

$$\frac{2}{Q_1} = 1 - \frac{200}{300} \Rightarrow Q_1 = 6$$

122. Consider a small element dx at a distance x from lower end.

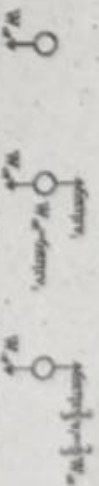


Tension at point $T = x \left(\frac{M}{L} \right) g$

$$\text{Stress} = \left(\frac{Mg}{L} \right) \frac{x}{A}$$

Strain energy of element = $\frac{1}{2} \times \left(\frac{\text{Stress}}{Y} \right)^2 \times Vol = \frac{1}{2} \left(\frac{Mg}{L} \times \frac{x}{A} \right)^2 \times \frac{A dx}{Y}$

$$\text{Strain energy of total wire} = \int_0^L \frac{1}{2} \frac{M^2 g^2}{Y^2 A} x^2 dx = \frac{M^2 g^2 L}{6AY}$$



123. Figure (1) Figure (2) Figure (3)

When the ball is just released, the net force on ball is $W \sin \theta$ (= mg - buoyant force)

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

$$\therefore \text{Viscous force } 6\pi \eta r v_t = W \sin \theta$$

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

Velocity v_t , the viscous force is $= \frac{2}{3} W \sin \theta$

Hence net force is $W \sin \theta - \frac{2}{3} W \sin \theta = \frac{1}{3} W \sin \theta$

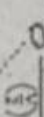
\therefore Required acceleration is $= \frac{d}{3}$

$$124. T = 2\pi \sqrt{\frac{l}{g}} = 2\pi \sqrt{\frac{l}{x^2}} = 2$$

All l 's amplitude, $y = \frac{A}{2}$

$$\text{Time period} = \left[\frac{T}{12} + \frac{T}{4} \right] \times 2 = \frac{4}{3} T$$

125. Conceptual



126.

$$\cos \theta = \frac{1}{2}$$

$$n^1 = \frac{Y}{Y - Y \cos \theta} \times n = \frac{Y}{Y(1 - \cos \theta)} \times n = \frac{4}{3} \times n$$

127. Conceptual

128. Initially $F = \sqrt{(V_C - V_A)^2 + V_B^2} = 10V$ and $X_A = X_C = R$

$$\text{Finally } F = \sqrt{V_B^2 + V_C^2} = \sqrt{2} V_C \Rightarrow V_C = \frac{10}{\sqrt{2}} V$$

129. emf in loop $\mathcal{E} = -\frac{d}{dt} (B \times \text{area}) = -\pi r^2 \frac{dB}{dt} = 2\pi r^2$

Current $I = \frac{\mathcal{E}}{R} = \frac{2\pi r^2}{R}$

Power $P = \mathcal{E} \times I = \frac{4\pi^2 r^4}{R}$

Charge $q = \int I dt = \int \frac{2\pi r^2}{R} dt = \frac{4\pi r^2}{R}$

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

131. $\Delta U = U_f - U_i = k_0 \left(\frac{Q_1 Q_2}{a+x} + \frac{Q_1^2}{2a} + \frac{Q_2^2}{2a} - \frac{3Q_1 Q_2}{a} - \frac{Q_1^2}{2a} \right)$

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

Show x' is small, $a^2 - x^2 \approx a^2$

$\Delta U = k_0 Q \left(\frac{2x^2}{a^2} \right)$

132. $\frac{E}{R} = C$

133. $\Delta U = 0$, charging of capacitor starts without opposition or back emf

$I = \frac{\mathcal{E}}{R} = \frac{2}{1000} = 2\text{mA}$

At steady state, no current flows through the path of capacitor

Current $I = \frac{\mathcal{E}}{R_1 + R_2} = \frac{2}{2000} = 1\text{mA}$

134. $B = \frac{\mu_0 I}{2\pi r} \Rightarrow B \propto \frac{1}{r}$



135. Radius of circle is a

Radius of path of charge particle is $\frac{2\pi r}{qB} = a$

A ABC equivalent to $\theta = \omega t$