Msc. Forensic Science

(472)

14P/302/27

Question Booklet No. .....

(To be filled up by the candidate by ***blue/black ball-point pen***)

Roll No. | | | | | | | | | |

Roll No.

(Write the digits in words) .....

Serial No. of Answer Sheet .....

.....

Day and Date ..... (Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only ***blue/black ball-point pen*** in the space above and on both sides of the Answer Sheet)

1. Within 10 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card without its envelope.*
3. A separate Answer Sheet is given. *It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.*
4. Write your *Roll Number and Serial Number of the Answer Sheet by pen* in the space provided above.
5. *On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.*
6. No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and Roll No. and OMR sheet No. on the Question Booklet.
7. Any changes in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfairmeans.
8. Each question in this Question Booklet is followed by four alternative answers. *For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by pen as mentioned in the guidelines given on the first page of the Answer Sheet.*
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed.* If you *do not wish to attempt* a question, leave all the circles in the corresponding row blank (such question will be awarded zero marks).
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Question Booklet.
12. Deposit *only the OMR Answer Sheet* at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

[उपर्युक्त निर्देश हिन्दी में अन्तिम आवरण-पृष्ठ पर दिये गये हैं।]

Total No. of Printed Pages : 34

Total No. of Questions : 240

No. of Questions to be Attempted : 120

Time : 2 Hours] *[Full Marks : 360*

Note : (i) Attempt as many questions as you can. Each question carries 3 marks. ***One mark will be deducted for each incorrect answer. Zero*** mark will be awarded for each unattempted question.

(ii) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

(iii) This question paper contains ***two*** Sections, viz : ***Section-A*** and ***Section-B.*** Details of ***Section-A*** and ***Section-B*** are as follows :

(a) **Section - A** contains **60** questions from General Sciences and **20** questions of General Nature.

(b) **Section - B** contains ***four*** sub-sections namely : Biology, Chemistry, Mathematics and Physics with **40** questions in each. The candidate has to select ***only one*** of the four sub-sections of ***Section-B.***

SECTION – A

1. The word 'Forensic' is derived from the word :

(1) Forejudge (2) Forge (3) Forum (4) Forsay

2. 'Odontology' is the study of :

(1) teeth (2) bone (3) birthmark (4) heart

3. 'Inebriety' is an acute intoxication by :

(1) alcohol (2) poison (3) drug (4) food

4. Parents mating of blood group O with O can have children with the group :

(1) A (2) B (3) AB (4) O

5. Match the following :

	List-I (Physical Evidence)		*List-II (Sections of Forensic Science Laboratory)*
(a)	Examination of twine	(i)	Biology Section
(b)	Examination of saliva	(ii)	Chemistry Section
(c)	Examination of pesticide	(iii)	Physics Section
(d)	Examination of adulteration of gasoline	(iv)	Toxicology Section

Codes :

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

6. Water is flowing through a horizontal pipe of non-uniform cross-section. At the extreme narrow portion of the pipe, the water will have :

(1) maximum speed and least pressure

(2) maximum pressure and minimum speed

(3) both pressure and speed minimum

(4) both pressure and speed maximum

7. Two plane mirrors are inclined at an angle of 45°C to each other. If an object is placed in between them, the number of images formed is :

(1) 4 (2) 5 (3) 6 (4) 7

8. The de-Broglie wavelength associated with an electron of energy 50 eV :

(1) 1.73 Å (2) 2.54 Å (3) 19.2 Å (4) 2.4 Å

9. By increasing the temperature of a liquid :

(1) volume and density decrease

(2) volume and density increase

(3) volume increase and density decrease

(4) volume decrease and density increase

10. The energy gap between conduction and valence bands of Silicon is :
(1) 2 eV (2) 1.7 eV (3) 1.1 eV (4) 1.0 eV

11. The instrument, which measure temperature by measuring the intensity radiations, is called :
(1) hydrometer (2) pyrometer (3) thermopile (4) thermometer

12. Generally, the approximate limit of visible spectrum is :
(1) 100 to 1500 Å (2) 2000 to 3500 Å
(3) 10000 to 14000 Å (4) 4000 to 7900 Å

13. A neutron can cause fission in :
(1) Uranium - 238 (2) Uranium - 235 (3) Thorium (4) Hydrogen

14. The colour of a star indicates its :
(1) velocity (2) temperature (3) size (4) length

15. The *pKa* of an acid having ionization constant 1×10^{-5} is :
(1) 9 (2) -9 (3) 5 (4) -5

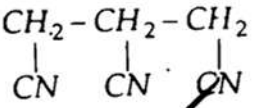
16. Which of the following is most soluble ?
(1) $Ag_2S\left(K_{sp} = 6 \times 10^{-51}\right)$ (2) $MnS\left(K_{sp} = 7 \times 10^{-16}\right)$
(3) $CuS\left(K_{sp} = 8 \times 10^{-37}\right)$ (4) $Bi_2S_3\left(K_{sp} = 1 \times 10^{-18}\right)$

17. Which of the following has largest size ?
(1) Al^{2+} (2) Al^{3+} (3) Al^{+} (4) Al

18. Iodine is liberated from *KI* solution when treated with :
(1) $CuSO_4$ (2) $NiSO_4$ (3) $ZnSO_4$ (4) $FeSO_4$

19. Semi-water gas is :
(1) $CO + H_2 + N_2$ (2) $CO + H_2$ (3) $CO + N_2$ (4) H_2

20. The IUPAC name of the compound



is :
(1) 1, 2, 3-tricyanopropane (2) 3-cyanopentane-1,5-dinitrile
(3) 1, 2, 3-cyanopropane (4) 1, 2, 3-propane trinitrile

P.T.O.

21. Grignard's reagent is prepared by reaction between :
(1) magnesium and alkyl halide
(2) zinc and alkyl halide
(3) magnesium and alkane
(4) magnesium and aromatic hydrocarbons

22. Fruit bearing plants are called :
(1) spermatophytes
(2) angiosperms
(3) dicotyledons
(4) gymnosperms

23. Blood capillary connects :
(1) venule with lymph vessel
(2) arteriole with venule
(3) artery with lymph vessel
(4) artery with vein

24. The branch of biology dealing with microscopic study of tissues is called :
(1) Classification (2) Cytology (3) Histology (4) Osteology

25. Oxygen is transported in the body by :
(1) Thrombocytes
(2) Blood plasma
(3) WBCs
(4) RBCs

26. During winters sometimes the body shows shivering, this is in order to :
(1) increased heat production by muscular contraction
(2) increased heat production by muscular friction
(3) check dispersion of body heat
(4) increase quantity of blood in skin

27. Maximum O_2 evolution occurs from :
(1) forests
(2) marine phytoplankton
(3) crops
(4) land mass

28. In 28 days human ovarian cycle, ovulation occurs in :
(1) day 1 (2) day 5 (3) day 12-14 (4) day 28

29. If α, β are the roots of the equation $x^2 - px + 36 = 0$, $\alpha + \beta = p$, and $\alpha^2 + \beta^2 = q$, then the value of p is :
(1) ± 8 (2) ± 9 (3) ± 6 (4) ± 3

30. If n is a positive integer, then $n^3 + 2n$ is divisible by :
(1) 2 (2) 3 (3) 5 (4) 6

31. The value of $(\sqrt{7} + \sqrt{6})(\sqrt{7} - \sqrt{6}) + 200$ is :
(1) 201 (2) 202 (3) 0 (4) 199

32. Which is the coldest layer of atmosphere ?
(1) Thermosphere (2) Mesosphere (3) Troposphere (4) Ionosphere

33. Dry ice is the solid form of :
(1) Ammonia (2) CO_2 (3) N_2 (4) O_2

34. The 'World Ozone Day' is celebrated on :
(1) March, 21 (2) September, 16 (3) April, 25 (4) June, 5

35. Computer program which is used to run the Website ?
(1) MOZILLA (2) MS-WORD (3) FOXPRO (4) UNIX

36. An operating system get their total memory initialized from :
(1) CPU (2) BIOS (3) ROM (4) RAM

37. A string of eight 0s and 1s is called a :
(1) megabyte (2) byte (3) kilobyte (4) gigabyte

38. What is the shortcut key for centering the text selected by the user in Word ?
(1) Ctrl + A (2) Ctrl + B (3) Ctrl + D (4) Ctrl + E

39. The acceleration of a train travelling with speed of 400 m/s as it goes round a curve of radius 160 m is :
(1) $1\ km/s^2$ (2) $100\ m/s^2$ (3) $10\ m/s^2$ (4) $1\ m/s^2$

40. We consider a thermodynamic process. If ΔU represents the increase in its internal energy and W. the work done by the system, which of the following statement is ***true*** ?
(1) $\Delta U = -W$ in an adiabetic process (2) $\Delta U = W$ in an isothermal process
(3) $\Delta U = -W$ in an isothermal process (4) $\Delta U = W$ in an adiabetic process

41. A nucleus ${}_nX^m$ emit one α and two β particles. The resulting nucleus is :
(1) ${}_nX^{m-4}$ (2) ${}_{n-2}Y^{m-4}$ (3) ${}_{n-4}Z^{m-4}$ (4) None of these

P.T.O.

42. Warm ocean surge of the Peru current recurring every 5 to 8 years or so in the East Pacific of South America is widely known as :

(1) Magnox (2) Gull Stream (3) El Nino (4) Aye Aye

43. Species restricted to a given area are called :

(1) sibling (2) endemic (3) sympatric (4) allopatric

44. How many genome types are present in a typical green plant's cell ?

(1) two (2) three (3) more than five (4) more than ten

45. What is major cause of diminishing wild life number ?

(1) Cannibalism (2) Habitat destruction

(3) Falling of tree (4) Paucity of drinking water

46. Human immuno deficiency virus (HIV) has a protein coat and a generic material which is :

(1) single stranded DNA (2) single stranded RNA

(3) double stranded RNA (4) double stranded DNA

47. Carbon mono-oxide is a pollutant because :

(1) its reacts with O_2 (2) it inhibits glycolysis

(3) reacts with haemoglobin (4) makes nervous system inactive

48. Which one of the following is ***not*** main function of lymph glands ?

(1) forming WBC (2) forming antibodies

(3) forming RBC (4) destroying bacteria

49. In mammals, histamine is secreted by :

(1) fibroblasts (2) histocytes

(3) lymphocytes (4) mass cells

50. Which important green-house gas, other than CO_2, is being produced from the agricultural field ?

(1) Arsine (2) Sulfur dioxide (3) Ammonia (4) Nitrous oxide

51. Given the numbers 161 cm, 0.0161 cm, and 0.0161 cm, the number of significant figures for the three numbers are :

(1) 3, 4, and 5 respectively (2) 3, 4, and 4 respectively

(3) 3, 3, and 4 respectively (4) 3, 3, and 3 respectively

52. In DNA the complementary bases are :

(1) adenine and thymine, guanine and cytosine

(2) uracil and adenine, cytosine and guanine

(3) adenine and guanine, thymine and cytosine

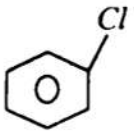
(4) adenine and thymine, guanine and uracil

53. Aspirin is an acetylation product of :

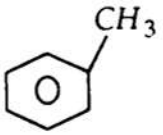
(1) o-hydroxy benzoic acid (2) o-hydroxy benzene

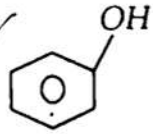
(3) m-hydroxy benzoic acid (4) p-dihydroxy benzene

54. Which one of the following compounds will be most easily attached by an electrophile ?

(1) 

(2) 

(3) 

(4) 

55. Which one of the following is planar ?

(1) XeF_4 (2) XeO_4 (3) XeO_3F (4) XeO_3F_2

56. Which of the following statements about pH and H^+ ion concentration is ***incorrect*** ?

(1) Addition of one drop of conc. HCl in NH_4OH solution decreases pH of the solution.

(2) A solution of the mixture of one equivalent of each of CH_3COOH and $NaOH$ has a pH of 7.

(3) pH of pure neutral water is not zero.

(4) A cold and conc. H_2SO_4 has lower H^+ ion concentration than a dilute solution of H_2SO_4.

57. Enzymes are absent in :

(1) algae (2) fungi (3) cyanobacteria (4) viruses

P.T.O.

58. A person suffering from the deficiency of the visual pigment rhodopsin is advised to take more of :

(1) radish and potato (2) apple and grapes

(3) carrot and ripe papaya (4) guava and ripe banana

59. Which one of the following amino acids is an essential part of human diet ?

(1) Glycine (2) Phenylalanine (3) Serine (4) Aspartic acid

60. In electrolysis the mass deposited on an electrode is directly proportional to :

(1) current (2) square of current

(3) concentration of electrolyte (4) inverse of current

[*Analytical Ability Reasoning and Logical Skills*]

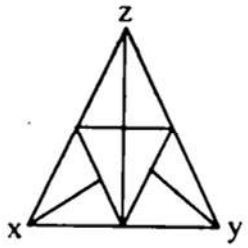
61. In a certain code GONE is written as '5% 2#' and MEDAL is written as '4 # 38@'. How is GOLD written in that code ?

(1) 5@ % 3 (2) 5 %@ 3 (3) 5 # @ 3 (4) 5% # 3

62. W walked 30 metre toward South, took a left turn and walked 50 meter, again he took a left turn and walked 30 meter. How far is he from the starting point ?

(1) 80 meter (2) 100 meter (3) 130 meter (4) 50 meter

63. Find the number of triangles in the given figure :



(1) 17 (2) 15 (3) 13 (4) 9

64. A, B, C, and D are 4 consecutive odd numbers and their average is 42. What is the product of B and D ?

(1) 1860 (2) 1890 (3) 1845 (4) 1677

65. In this question, a word has been given followed by four other words, one of which ***cannot*** be formed using the letters of the given word. Find the word :

CHEMOTHERAPY

(1) HECTARE (2) MOTHER (3) THEATRE (4) RAPED

66. Select the related word from the given alternatives :

LACONIC : VERBOSE : : LAUDATORY : ?

(1) COMBINED (2) COMPLETENESS

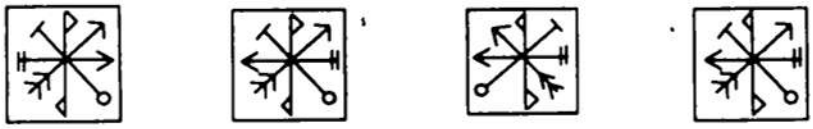
(3) DEFAMATORY (4) SYMMETRY

67. From the answer figures, find out the figure which is the exact mirror image of the question figure, when the mirror is placed on the line 'MN' :

Question Figure :



Answer Figure :



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

68. Solve the following equations :

$$6x + y = 23 \quad \ldots\ldots \quad \text{(i)}$$

$$6(5x + 6y) = 270 \quad \ldots\ldots \quad \text{(ii)}$$

Report whether :

(1) $x > y$ (2) $x < y$ (3) $x \leq y$ (4) $x = y$

Directions (Q. Nos. 69 & 70) : *Following questions are based on the five three-digit numbers given below :*

826, 391, 435, 678, 283

69. If the positions of the first and second digits within eacher number are interchanged, which of the following will be the second digit of the highest number ?

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

70. Which of the following is the difference between second and third digits of the second lowest number ?

(1) 5 (2) 8 (3) 2 (4) 1

P.T.O.

Directions (Q. Nos. 71 to 75) : Study the following information carefully and answer the given questions :

Five friends P, Q, R, S and T travelled separately to five different cities namely Chennai, Kolkata, Delhi, Hyderabad and Manglore by different modes of transport i.e. by bus, train, aeroplane, car and boat from Goa.

The person who travelled to Delhi did not travel by boat. R travelled to Manglore by car and S travelled by boat. Q travelled to Kolkata by aeroplane and T travelled by train. Goa is not connected by bus to Delhi and Chennai.

71. S travelled to ..... by ..... :

(1) Hyderabad, train (2) Chennai, boat

(3) Chennai, train (4) Delhi, boat

72. Who amongst the following travelled to Delhi ?

(1) T (2) R (3) S (4) P

73. Q : Kolkata in the same way as S : ?

(1) Hyderabad (2) Chennai (3) Manglore (4) Delhi

74. Which of the following combinations of place and transport is ***correct*** ?

(1) Kolkata - Bus (2) Delhi - Aeroplane

(3) Manglore - Train (4) Chennai – Boat

75. Which of the following combinations is ***true*** for P ?

(1) Travelled to Kolkata by bus (2) Travelled to Delhi by train

(3) Travelled to Chennai by boat (4) Travelled to Hyderabad by bus

76. 'Zinc' is related to 'Galvanization' as 'Nickel' is to :

(1) Aircraft (2) Corrosion (3) Electroplating (4) Filament

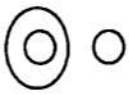
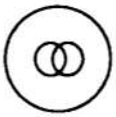
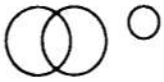
77. Choose the number pair/group which is different from others ?

(1) 1(5)2 (2) 7(113)8 (3) 2(20)4 (4) 3(17)4

78. A man is facing West. He turns 45° in the clockwise direction and then another 180° in the same direction and then 270° in the anti-clockwise direction. Which direction is he facing now ?

(1) South (2) North-West (3) West (4) South-West

79. Choose the Venn diagram which best illustrate the three given classes : protons, electrons and atoms :

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

80. If $A > B$, $B > C$ and $C > D$, then which of the following conclusions is definitely wrong ?

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

SECTION – B
[*Biology*]

81. Which of the following is used as biofertilizer ?

(1) Ammonia (2) Nitrogen (3) Azolla (4) Bagasse

82. What is the botanical name of paddy ?

(1) *Solanum lycopersicum* (2) *Triticum aestivum*
(3) *Eleusine coracana* (4) *Oryza sativa*

83. *Azadiracta indica* is the botanical name of :

(1) Mango (2) Banana (3) Cucumber (4) Neem

84. The tallest living tree is :

(1) Sequoia (2) Palm tree (3) *Eucalyptus* (4) Yew plant

85. Which combination of cellular organelles is present in plant cell ?

(1) Chloroplast, cell wall, nucleus
(2) Nucleus, chloroplast, cytoplasm
(3) Cell wall, cell membrane, vacuole
(4) Cell membrane, nucleus, cytoplasm

86. The aflatoxin found in post- harvested grains is produced by :

(1) *Fusarium* (2) *Penicillium* (3) *Verticillium* (4) *Aspergillus*

87. Cellular organelles containing hydrolytic enzymes are called :

(1) Mesosomes (2) Peroxisomes (3) Ribosomes (4) Lysosomes

88. Which one of the following is ***wrongly*** matched ?

(1) Antibody-Glycoprotein (2) Fungi- Chitin
(3) Phospholipids- Plasma membrane (4) Enzyme- Lipopolysachride

P.T.O.

89. Ripening of fruits can be fastened by treatment with :
(1) Abscisic acid (2) Gibberellin (3) Auxins (4) Ethylene

90. Photosynthetically active radiation represents following range of wavelength :
(1) 400- 700 (2) 200- 300 (3) 100- 300 (4) 600- 800

91. Organism that is used for alcoholic fermentation is :
(1) *Pseudomonas* (2) *Streptomyces* (3) *Saccharomyces* (4) *Fusarium*

92. Synthetic seed is produced by encapsulating somatic embryo with :
(1) Sodium alginate (2) Sodium citrate
(3) Sodium nitrate (4) Sodium chloride

93. Synthesis of glucose from fats is called :
(1) Glycolysis (2) Glycogenolysis
(3) Gluconeogenesis (4) Saponification

94. Enzyme that is used to join DNA fragment :
(1) Reverse transcriptase (2) DNA polymerase
(3) DNA topoisomerase (4) DNA ligase

95. An infectious agent composed of only protein is :
(1) Virions (2) Prions (3) Virusoids (4) Virus

96. The DNA content is doubled during which of the following stage of cell division :
(1) S phase (2) G1 phase (3) G2 phase (4) Metaphase

97. Which of the following is the most primitive group of algae ?
(1) Green algae (2) Red algae
(3) Blue green algae (4) Brown algae

98. Fungi usually store the reserve food material in the form of :
(1) Protein (2) Lipid (3) Glycogen (4) Starch

99. Taq polymerase is obtained from :
(1) *Thermus aquaticus* (2) *Thermus thermophillus*
(3) *Pyrococcus furiosus* (4) *Chromobacterium violaceum*

100. Short sequences of DNA used for identification of complimentary sequences in a sample are known as :

(1) Marker (2) Minisatellite (3) Microsatellite (4) Probe

101. In sea urchins, the Aristotle's Lantern is used as :

(1) light producing organ (2) feeding organ

(3) locomotor organ (4) excretory organ

102. Members of which of the following phyla are known as 'Sea Walnuts' ?

(1) Porifera (2) Coelentrata

(3) Ctenophora (4) Echinodermata

103. Vertebrae types found in mammals are :

(1) Procoelous (2) Amphicoelous (3) Heterocoelous (4) Acoelous

104. Ecdysone, the hormone responsible for insect metamorphosis is secreted by :

(1) Corpora cardiaca (2) Prothoracic gland

(3) Corpora allata (4) Intercerebral gland cells

105. What insects are the first to appear on the dead body ?

(1) Beetles (2) Ants (3) Flies (4) Mites

106. Which group of peptides is produced after cleavage of the following peptide with trypsin ?

Met – Ala – Tyr – Met – Phe – Arg – Gly – Asp – Lys – Glu – Trp

(1) Met – Ala – Tyr – Met – Phe – Arg, Gly – Asp – Lys, Glu – Trp

(2) Met – Ala – Tyr – Met – Phe, Arg – Gly – Asp – Lys – Glu – Trp

(3) Met – Ala – Tyr – Met – Phe – Arg – Gly – Asp, Lys – Glu – Trp

(4) Met – Ala – Tyr – Met, Phe – Arg – Gly – Asp – Lys – Glu – Trp

107. How many high energy phosphate bond equivalent are utilized in the process of activation of amino acids for protein synthesis ?

(1) One (2) Two (3) Three (4) Four

108. During anaerobic exercise, ATP is produced as a byproduct of which pathway ?

(1) Glycogen breakdown (2) Glycolysis

(3) Oxidative phosphorylation (4) Pentose phosphate pathway

P.T.O.

109. 2, 4-dinitrophenol and oligomycin inhibit oxidative phosphorylation. 2, 4-dinitrophenol is an uncoupling agent, therefore, 2, 4-dinitrophenol will :

(1) Block electron transfer in the presence of oligomycin
(2) Allow electron transfer in the presence of oligomycin
(3) Block oxidative phosphorylation in the presence of oligomycin
(4) Allow oxidative phosphorylation in the presence of oligomycin

110. Which of the following pathways is most correctly considered to be amphibolic ?

(1) Lipolysis (2) Glycolysis
(3) Gluconeogenesis (4) Citric acid cycle

111. A woman with no family history of color-blindness marries a color-blind man. What are the risks for this couple of having a son or daughter who is color-blind ?

(1) 100% (2) 50% (3) 25% (4) Virtually 0

112. Which of the following statements about hemophilia A is ***true*** ?

(1) The extrinsic clotting pathway is impaired
(2) Activation of factor XI is impaired
(3) Activation of factor XII is impaired
(4) Activation of factor X is impaired

113. Which of the following is noted in Cushing's syndrome ?

(1) Decreased production of epinephrine
(2) Excessive production of epinephrine
(3) Excessive production of cortisol
(4) Decreased production of cortisol

114. A non-competitive inhibitor of an enzyme does which of the following ?

(1) Decreases V_{max}
(2) Decreases K_m and decreases V_{max}
(3) Increases K_m with no or little change in V_{max}
(4) Increases V_{max}

115. The membrane potential will be depolarized by the greatest amount if the membrane permeability increases for :

(1) Potassium (2) Sodium and Potassium
(3) Potassium and Chloride (4) Sodium

116. Dietary fat, after being processed, is extruded from mucosal cells of gastrointestinal tract into the lymphatic ducts in the form of :

(1) Monoglycerides (2) Diglycerides

(3) Free fatty acids (4) Chylomicrons

117. Nearly all binding of cobalamin to intrinsic factor occurs in :

(1) Stomach (2) Duodenum (3) Jejunum (4) Colon

118. Which of the following substances will be more concentrated at the end of the proximal tubule than at the beginining of the proximal tubule ?

(1) Bicarbonate (2) Creatinine (3) Glucose (4) Sodium

119. Which of the following is the ultimate source of genetic variation in a population ?

(1) Gene flow (2) Assortive mating

(3) Mutation (4) Selection

120. Which of the following is ***not*** an assumption of the Hardy-Weinberg equilibrium ?

(1) Mating occurs preferentially (2) The size of the population is large

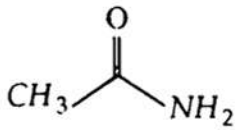
(3) There is no migration (4) There are no mutations

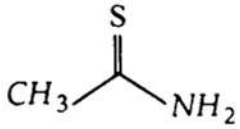
[*Chemistry*]

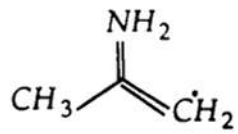
121. Which one of the following pairs represents a set of electrophiles ?

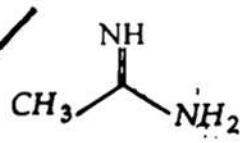
(1) $\overset{\oplus}{Br}$ and $\ddot{C}Cl_2$ (2) $H^{\oplus}$ and H_2O (3) BF_3 and NH_3 (4) $\overset{\ominus}{H}$ and $AlCl_3$

122. Which one of the following compound is the most basic in aqueous solution ?

(1) 

(2) 

(3) 

(4) 

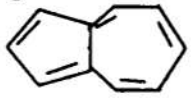
123. In the conversion of a Grignard reagent into an aldehyde, the other components used are :

(a) $HCOOC_2H_5$ (b) $CH_3COOC_2H_5$ (c) CO_2 (d) HCN

Correct code is :

(1) "a", "c" and "d" (2) "a" and "d" (3) "a" and "b" (4) "b" and "d"

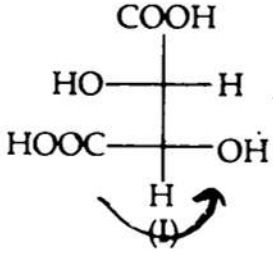
124. The compound (I) given below is :



I

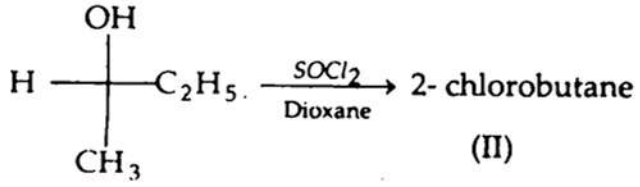
(1) Aromatic and has high dipole moment
(2) Aromatic and has no dipole moment
(3) Non-aromatic and has high dipole moment
(4) Anti-aromatic and has no dipole moment

125. The structural representation of Tartaric acid (I) as shown below, has :



(1) a plane of symmetry
(2) a centre of symmetry
(3) both plane and point of symmetry
(4) neither plane nor point of symmetry

126. An optically active alcohol (I) reacts with $SOCl_2$ to form product (II) as shown below :



(I) (II)

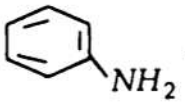
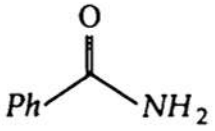
In this regard, which one of the following statement is ***true*** ?

(1) I and II both have S-configuration (2) I and II both have R-configuration
(3) I is R-isomer and II is S-isomer (4) I is S-isomer and II is R-isomer

127. Rapid interconversion of α-D-glucose and β-D-glucose in solution is known as :

(1) Racemization
(2) Fluxional isomerization
(3) Mutarotation
(4) Asymmetric induction

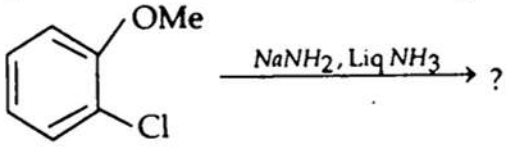
128. From List-I and List-II, the correct answer using the given ***codes*** is :

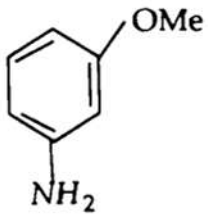
List-I	***List-II***
(a) Bayer-Villiger Rearrangement	(i) $Ph-CHO \xrightarrow{Zn/BrCH_2COOE+}$
(b) Haloform Reaction	(ii)  $\xrightarrow[PhNO_2, FeSO_4]{glycerol, H_2SO_4}$
(c) Scraup Reaction	(iii)  $\xrightarrow[NaOH]{H_2O_2}$
(d) Hoffman Rearrangement	(iv) $Ph-CH(OH)CH_3 \xrightarrow{I_2/NaOH}$
(e) Reformalisky Reaction	(v)  $\xrightarrow{Br_2/NaOH}$

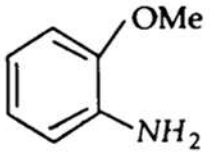
Codes :

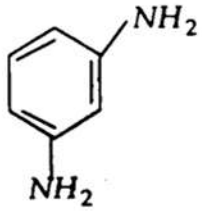
	(a)	(b)	(c)	(d)	(e)
(1)	iv	iii	i	v	ii
(2)	iii	iv	ii	v	i
(3)	i	iii	ii	v	iv
(4)	i	iv	v	ii	iii

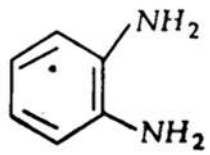
129. The major product formed in the following reaction is :



(1) 

(2) 

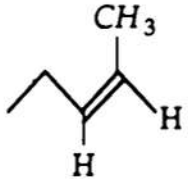
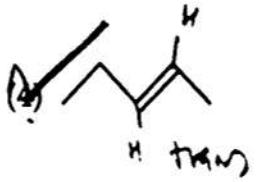
(3) 

(4) 

130. In the following reaction :

$$C_2H_5 - C \equiv C - CH_3 \xrightarrow[(ii)\ H_3O^{\oplus}]{(i)\ Na|Liq\ NH_3|THF-40^{\circ}C} (P)$$

the major product (P) will be :

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

131. Insects can walk on the surface of water due to :
(1) optical activity (2) refractivity (3) surface tension (4) viscosity

132. Which is ***not*** affected by temperature ?
(1) Molarity (2) Normality (3) Formality (4) Molality

133. What is the elevation in boiling point for a solution containing 18 g glucose in 100 g water ? Given elevation constant of water is 0.52 K kg mol^{-1} :
(1) 0.72 K (2) 0.62 K (3) 0.52 K (4) 0.42 K

134. Which of the following compounds is frequently used as an internal inference in 1H NMR spectroscopy ?
(1) DMSO (2) THF (3) TMS (4) DMF

135. The degree of hydrolysis of a salt of weak acid and weak base is given by the expression :
(1) $\alpha = \sqrt{\frac{K_w.K_b}{K_a}}$ (2) $\alpha = \sqrt{\frac{K_w.K_a}{K_b}}$ (3) $\alpha = \sqrt{\frac{K_w}{K_a.K_b}}$ (4) $\alpha = \sqrt{K_w.K_a.K_b}$

136. The emf of the cell : $Zn \mid Zn^{2+}(0.001M)$II $Ag^{+1}(0.1M)\ I\ Ag$ with standard potentials of Ag/Ag^{+} and Zn/Zn^{+2} half cells of + 0.80 V and - 0.76 V, respectively, is :
(1) 1.985 V (2) 1.888 V (3) 1.958 V (4) 1.589 V

137. The change in the Gibbs free energy of 4 moles of an ideal gas which expand isothermally from 1 L to 10 L at 300 K (R = 8.314 $JK^{-1}mol^{-1}$) :
(1) -- 21.97 kJ (2) - 22.97 kJ (3) - 23.97 kJ (4) - 24.97 kJ

138. Ratio of the translational partition functions of hydrogen molecules confined in a 100 cm^3 vessel at 300 K and 2700 K is :
(1) 1 : 13.5 (2) 1 : 27 (3) 1 : 54 (4) 1 : 108

139. The heat of combustion of ethyl alcohol is –330 Kcal. If the heat of formation CO_2(g) and H_2O(I) be – 94.3 Kcal and –68.5 Kcal, respectively. The heat of formation of ethyl alcohol is :.

(1) – 64.1 Kcal (2) – 84.1 Kcal (3) – 104.1 Kcal (4) – 124.1 Kcal

140. 50 mL of 1 M oxalic acid (molar mass = 126 g mol^{-1}) is shaken with 0.5 g of wood charcoal. The final concentration of the solution after adsorption is 0.5 M. What is the amount of oxalic acid adsorbed per gram of carbon ?

(1) 12.60 g (2) 6.30 g (3) 3.15 g (4) 1.575 g

141. The stability of dihalides of elements of carbon family increases in the order :

(1) $CX_2 < SiX_2 < GeX_2 < SnX_2 < PbX_2$

(2) $CX_2 < GeX_2 < SnX_2 < SiX_2 < PbX_2$

(3) $GeX_2 < CX_2 < SnX_2 < PbX_2 < SiX_2$

(4) $SnX_2 < PbX_2 < GeX_2 < SiX_2 < CX_2$

142. Which one of the following is ***not*** tetrahedral and diamagnetic ?

(1) $Ni(CO)_4$ (2) $Ni(CN)_4^{4-}$ (3) $Ni(PR_3)_4$ (4) $NiCl_4^{2-}$

143. Which one of the following does ***not*** have spinal structure ?

(1) Mn_3O_4 (2) Co_3O_4 (3) Fe_3O_4 (4) $Mg[Cr_2O_4]$

144. Intensity of d-d transitions is governed by a set of selection rules given by :

(1) $\Delta s = 0, \Delta l = 0$ (2) $\Delta s \neq 0, \Delta l = \pm 1$ (3) $\Delta s \neq 0, \Delta l = 0$ (4) $\Delta s = 0, \Delta l = \pm 1$

145. Purple colour of $[Ti(H_2O)_6]\ Cl_3$ is due to :

(1) d-d transition

(2) charge transfer transition

(3) ligand transition

(4) charge transfer and ligand transition

146. Ba^{2+}, Sr^{2+} and Ca^{2+} are precipitated as carbonates in their qualitative analysis by adding NH_4OH, NH_4Cl and $(NH_4)_2CO_3$ solution. The reagents are added in the following sequence :

(1) NH_4OH, NH_4Cl, $(NH_4)_2CO_3$

(2) NH_4Cl, NH_4OH, $(NH_4)_2CO_3$

(3) $(NH_4)_2CO_3$, NH_4OH, NH_4Cl

(4) All are added simultaneously

147. Clathrate compounds like $Xe(H_2O)_6$ involve :

(1) Ionic bond (2) Covalent bond

(3) Coordinate bond (4) Weak forces

148. $Fe(Et_2NCS_2)_3$ shows magnetic moments 4.3 BM at 297 K and 2.2 BM at 79 K. This is because :

(1) 10 Dq > P (2) 10 Dq < P

(3) 10 Dq ≅ P (4) No relation between 10 Dq and P

(10 Dq and P are crystal field splitting energy and pairing energy of metal ion respectively.)

149. Zinc-EDTA complex has following coordination number and geometry :

(1) 6, octahedral (2) 4, octahedral (3) 4, square planar (4) 4, tetrahedral

150. The bond angle in hydrides of nitrogen family decreases in the order :

(1) $NH_3 > PH_3 > AsH_3 > SbH_3$ (2) $PH_3 > NH_3 > AsH_3 > SbH_3$

(3) $AsH_3 > PH_3 > NH_3 > SbH_3$ (4) $SbH_3 > AsH_3 > NH_3 > PH_3$

151. Two essential prerequisites for the validity of distribution law are :

(1) constant temperature and the existence of similar species in two phases

(2) varying temperature and the existence of similar species in two phases

(3) constant pressure and the existence of similar species in two phases

(4) constant temperature and the existence of at least one species in either of the two phases

152. The units of absorbance and molar absorptivity are :

(1) no unit and $dm^3 mol^{-1} cm^{-1}$, respectively

(2) $dm^3 mol^{-1} cm^{-1}$ and no unit, respectively

(3) both unitless

(4) $mol^{-1} cm^{-1}$ and $dm^3 mol^{-1} cm^{-1}$

153. Beer's law governs the behaviour of :

(1) concentrated solutions only

(2) dilute solutions only

(3) both dilute and concentrated solutions

(4) pure solvent only

154. Which of the following is a planar chromatography ?

(1) Gas chromatography (2) HPLC

(3) TLC (4) Ion-exchange chromatography

155. One mole of $KBrO_3$ in bromate-bromide reaction produces :

(1) one mole Br_2 (2) two moles Br_2

(3) three moles Br_2 (4) four moles Br_2

156. The equivalence point pH in the titration of weak base with standard hydrochloric acid is :

(1) in acidic range (2) in basic range

(3) in mild basic range (4) neutral

157. Ce(IV) solution is used for the titration of reductants only in :

(1) strong basic medium (2) weak basic medium

(3) weak acidic medium (4) strong acidic medium

158. The dissolved oxygen levels in natural as well as waste-waters can be determined by :

(1) conductrometric method (2) spectrophotometric method

(3) pH-metric titration method (4) Winkler's method

159. Which of the following relationships is ***correct*** one ?

(1) $A = \log \% T - 2$ (2) $A = \log T - 2$

(3) $A = \ln \% T - 2$ (4) $A = 2 - \log \% T$

160. What are pH values of 10^{-9} M *HCl*, 1.0 M *HCl* and 10^{-2} M *NaOH* aqueous solutions ?

(1) 6.9, 1.0, 2.0 (2) 6.9, 0.0, 12.0 (3) 6.9, 1.0, 2.0 (4) 6.9, 1.1, 12.0

[*Mathematics*]

161. If P and Q are functions of x, then solution of a differential equation $\frac{dy}{dx} + Py = Q$ is :

(1) $ye^{\int P\,dx} = \int Qe^{\int P dx}\,dx + c$ (2) $y = e^{\int P\,dx} \int Qe^{\int P dx}\,dx + c$

(3) $ye^{P} = \int Qe^{\int P dx}\,dx + c$ (4) None of these

162. The general solution of a differential equation $y'' + n^2 y = 0$ is :

(1) $y = A\cos nx + B\sin nx$ (2) $y = A(\cos nx)^2 + B(\sin nx)^2$

(3) $y = A\cos n^2 x + B\sin n^2 x$ (4) None of these

163. If P and Q are functions of x such that $P + Qx = 0$, then a solution of the differential equation $y'' + Py' + Qy = 0$ is :

(1) $y = e^x$ (2) $y = e^{2x}$ (3) $y = x$ (4) None of these

164. $P_n(x)$ is the coefficient of h^n in the expansion of :

(1) $\left(1 + 2hx + h^2\right)^{\frac{1}{2}}$ (2) $\left(1 - 2hx + h^2\right)^{\frac{1}{2}}$ (3) $\left(1 + 2hx - h^2\right)^{\frac{-1}{2}}$ (4) None of these

165. The necessary condition for convergence of the series $\sum_{n=1}^{\infty} u_n$ of real numbers is :

(1) $u_n \to 0$ as $n \to \infty$ (2) $u_n \to 1$ as $n \to \infty$

(3) $u_n \to 2$ as $n \to \infty$ (4) None of these

166. The radius of curvature at origin for the curve for $x^3 - y^3 - 2x^2 + 6y = 0$ is :

(1) 1/3 (2) 2/3 (3) 3 (4) None of these

167. If $u = r\cos\theta$, $v = r\sin\theta$, $w = z$, then $\dfrac{\partial(u, v, w)}{\partial(r, \theta, z)}$ is :

(1) 1 (2) 2 (3) 3 (4) None of these

168. The volume generated by revolving the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ about x-axis is :

(1) $\dfrac{16}{35}\pi a^3$ (2) $\dfrac{16}{105}\pi a^3$ (3) $\dfrac{32}{105}\pi a^3$ (4) None of these

169. $2\int_0^{\frac{\pi}{2}} \sqrt{\tan\theta}\, d\theta =$

(1) $\Gamma\left(\frac{3}{4}\right)\Gamma\left(\frac{1}{2}\right)$ (2) $\Gamma\left(\frac{3}{4}\right)\Gamma\left(\frac{1}{4}\right)$ (3) $\frac{1}{2}\Gamma\left(\frac{3}{4}\right)\Gamma\left(\frac{1}{4}\right)$ (4) None of these

170. The maximum value of directional derivative of $\phi(x, y, z) = x^2 - 2y^2 + 4z^2$ at the point $(1, 1, -1)$ is :

(1) $\sqrt{\frac{7}{3}}$ (2) 84 (3) $\frac{7}{3}$ (4) None of these

171. The set $[a, b]$ with $a < b$ is :

(1) an open set

(2) bounded

(3) neither bounded below nor bounded above

(4) none of these

172. Let $X = C[a, b]$ be the space of real-valued continuous functions defined on the interval $[a, b]$ and define $d(x, y) = \sup_{s \in [a, b]} |x(s) - y(s)|$, $x, y \in X$ and $d_1(x, y) = \int_0^1 |x(s) - y(s)|\, ds, x, y \in X$. Then :

(1) (X, d) is not a metric space (2) (X, d_1) is not a metric space

(3) (X, d_1) is a complete metric space (4) None of these

173. Which of the following is ***not*** a basis of $\mathbb{R}^3(\mathbb{R})$?

(1) $[(1, 2, 3), (-1, -2, 0), (0, 0, -3)]$

(2) $[(1, -1, -1), (-1, 1, -1), (-1, -1, 1)]$

(3) $[(1, 1, 1), (1, 1, 0), (1, 0, 0)]$

(4) $[(1, 2, 3), (2, 1, 3), (3, 1, 2)]$

174. The function $f(z) = |z|$ is :

(1) analytic (2) f is differentiable at $z = 0$

(3) not analytic (4) None of these

175. If $L\{F(t)\} = f(s)$, then $L\{t^n F(t)\} =$

(1) $\frac{d^n}{ds^n}[f(s)]$ (2) $(-1)^n \frac{d^n}{ds^n}[f(s)]$ (3) $\int_s^\infty f(x)\, dx$ (4) None of these

176. For the values $f(0) = 3, f(1) = 6, f(2) = 11, f(3) = 18, f(4) = 27$, the form of the function $f(x)$ is :

(1) $x^2 + 2x + 3$ (2) $x^2 - 2x + 3$ (3) $x^2 + 4x + 3$ (4) $x^2 + 2x + 4$

177. Newton's iterative formula for obtaining a^{-1} is :

(1) $x_{n+1} = x_n(2 + ax_n)$ (2) $x_{n+1} = x_n(2 - ax_n)$

(3) $x_{n+1} = x_n(1 + ax_n)$ (4) $x_{n+1} = x_n(1 - ax_n)$

178. If $A = \{1, 2, 3, 4\}$, then which of the following is function from A to itself :

(1) $f_1 = \{(x, y) : x - y = 5\}$ (2) $f_2 = \{(x, y) : x - y = 6\}$

(3) $f_3 = \{(x, y) : x + y = 5\}$ (4) $f_4 = \{(x, y) : x + y > 4\}$

179. If $A = \{(x, y) : y = e^x, x \in \mathbb{R}\}$ and $B = \{(x, y) : y = e^{-x}, x \in \mathbb{R}\}$, then :

(1) $A \cap B = \phi$ (2) $A \cap B \neq \phi$ (3) $A \cup B = \mathbb{R}^2$ (4) None of these

180. The maximum value of $a \sin x + b \cos x$ is :

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

(3) $\sqrt{a - b}$ (4) $2\sqrt{a^2 + b^2 + a + b}$

181. The point of intersection of the line

$\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{3}$ and $\frac{x-4}{2} = \frac{y-6}{3} = \frac{z-7}{3}$ is :

(1) (2, 3, 3) (2) (2, 3, 4) (3) (1, 2, 3) (4) (1, 2, 4)

182. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{-3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are perpendicular to each other, then k is equal to :

(1) $\frac{10}{7}$ (2) $\frac{7}{10}$ (3) $\frac{10}{11}$ (4) $\frac{-10}{7}$

183. The radius of curvature at the origin for the curve $r^n = a^n \sin(n\theta)$ is given by :

(1) $\frac{a^n}{(n+1)r^{n-1}}$ (2) $\frac{na^n}{(n+1)r^{n-1}}$ (3) $\frac{a^n}{(n+1)r^n}$ (4) None of these

184. If $z = f(x + ay) + g(x - ay)$, then :

(1) $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$ (2) $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$

(3) $\frac{\partial^2 z}{\partial y^2} = a \frac{\partial^2 z}{\partial x^2}$ (4) $\frac{\partial^2 z}{\partial y^2} = a \frac{\partial^2 z}{\partial x^2} = 0$

185. $\lim_{n \to \infty} \left[\frac{n!}{n^n} \right]^{\frac{1}{n}}$ is equal to :

(1) 0 (2) 1 (3) e (4) e^{-1}

186. $\lim_{n \to \infty} x^n = 0$ for :

(1) $x < 1$ (2) $-1 < x \leq 1$ (3) $|x| < 1$ (4) $x = 1$

187. If two spheres of radii r_1 and r_2, respectively cut orthogonally, then the radius of common circle is :

(1) $r_1 r_2$ (2) $\sqrt{r_1^2 + r_2^2}$ (3) $r_1 r_2 \sqrt{r_1^2 + r_2^2}$ (4) $\frac{r_1 r_2}{\sqrt{r_1^2 + r_2^2}}$

188. The equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{2z}{c}$:

(1) an ellipsoid (2) a hyperboloid

(3) an elliptic paraboloid (4) a hyperbolic paraboloid

189. $\lim_{x \to \infty} \left(3^x + 4^x\right)^{\frac{1}{x}}$ is equal to :

(1) $3e$ (2) $4/e$ (3) $4e$ (4) 4

190. The polar equation $\frac{4}{r} = 3 + 4\cos\theta + 3\sin\theta$ represents :

(1) a hyperbola (2) an ellipse (3) a parabola (4) a circle

191. The orthogonal trajectory of the curve $r^n \sin n\theta = a^n$ is :

(1) $r^n \tan n\theta = c$ (2) $r^n \operatorname{cosec} n\theta = c$ (3) $r^n \cos n\theta = c$ (4) None of these

192. The number of the asymptotes parallel to the coordinates axes, of the curve $x^2y^3 + x^3y^2 = x^3 + y^3$ is :

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

193. The set $\{1, -1\} \cup \left\{\pm\left(1+\frac{1}{n}\right) : n \in \mathbb{N}\right\}$ is :

(1) closed but not open
(2) open but not closed
(3) closed and open both
(4) None of these

194. The value of the integral $\int_0^\infty 2^{-9x^2} dx$ is :

(1) $\frac{1}{2}\frac{\sqrt{\pi}}{\log 2}$ (2) $\frac{1}{3}\sqrt{\frac{\pi}{\log 2}}$ (3) $\frac{1}{6}\sqrt{\frac{\pi}{\log 2}}$ (4) 0

195. The function $f(x,y) = \begin{cases} \frac{x^3 + 2y^3}{x^2 + y^2} & , (x,y) \neq (0,0) \\ 0 & , (x,y) = (0,0) \end{cases}$ is :

(1) continuous and differentiable at (0, 0)
(2) continuous but not differentiable at (0, 0)
(3) neither continuous nor differentiable at (0, 0)
(4) continuous but partial derivatives does not exits at (0, 0)

196. If A is any square matrix then which of the following is ***not*** Hermitian ?

(1) $A + A^*$ (2) A^*A (3) AA^* (4) $A - A^*$

197. The matrices $A^{-1}B$ and BA^{-1} have :

(1) same eigenvalues and same eigenvectors
(2) different eigenvalues and different eigenvectors
(3) same eigenvalues, but different eigenvectors
(4) None of these

198. Solution of a differential equation $ydx - xdy + e^{\frac{1}{x}} dx = 0$ is :

(1) $y^2 + xe^{\frac{1}{x}} = cx^2$ (2) $y^2 + xe^{\frac{1}{x}} = cx^3$

(3) $y + x^2e^{\frac{1}{x}} = cx$ (4) $y + xe^{\frac{1}{x}} = cx$

199. Let α and x_0 be positive numbers and $\{x_n\}$ is a sequence defined by $x_{n+1} = \frac{1}{2}\left(x_n + \frac{\alpha}{x_n}\right)$. Then $\lim_{n\to\infty} \frac{x_n}{\sqrt{\alpha}}$ is :

(1) 0 (2) 1 (3) α (4) -1

200. Let G be a finite abelian group of odd order and $H = \{x^2 : x \in G\}$. Then :

(1) $H = G$

(2) H is a proper subgroup of G

(3) H is a subgroup of G iff G is cyclic

(4) H may not be a subgroup of G

[*Physics*]

201. De-Broglie wavelength λ is defined as :

(1) $\lambda = h/p$ (2) $\lambda = p/h$ (3) $\lambda = \hbar/p$ (4) $\lambda = c/v$

where h and p are Planck's constant and momentum respectively

202. Two springs of spring constants k_1 and k_2 respectively, are connected in series. The effective spring constant k_{eff} will be :

(1) $k_{eff} = k_1 + k_2$ (2) $1/k_{eff} = \frac{1}{k_1} + \frac{1}{k_2}$

(3) $k_{eff} = k_1 / k_2$ (4) $k_{eff} = \sqrt{k_1 k_2}$

203. Kepler's third law implies that :

(1) τ/a = constant (2) τ^3/a^2 = constant (3) τ^2/a^3 = constant (4) a/τ = constant

where τ is the time period and a is the average distance (semi major axis).

204. In a Balmer series, frequencies of successive lines tend to a limiting value :

(1) $cR/8$ (2) $cR^2/8$ (3) $c^2R/8$ (4) $cR/4$

where c is the speed of light and R is the Rydberg constant.

205. Suppose that two particles are travelling opposite to each other with velocity $v_x = \pm 0.9c$ as observed in the frame of reference S. What is the velocity of one particle with respect to the other that is measured by other ?

(1) 1.8c (2) 0 (3) .9c (4) 0.994c

206. At T = 0 K, which will exert maximum pressure ?

(1) particles, which follow ideal gas equation

(2) particles, which follow Maxwell Boltzmann distribution

(3) particles, which follow Bose-Einstein distribution

(4) particles, which follow Fermi-Dirac distribution

207. The reduced mass μ of a binary system of mass m_1 and m_2 is given by :

(1) $\mu = \frac{m_1 m_2}{m_1 + m_2}$ (2) $\mu = \frac{m_1 + m_2}{m_1 m_2}$ (3) $\mu = \frac{m_1 m_2}{m_1 - m_2}$ (4) $\mu = \frac{m_1 - m_2}{m_1 m_2}$

208. The source of energy of Sun is due to :

(1) fusion (2) fission

(3) radioactive decay (4) black body radiation

209. The voltage across a diode in a central tap full wave rectifier having input voltage of peak value V_m, during its non-conducting period is :

(1) 0 (2) V_m (3) $-2V_m$ (4) $-4V_m$

210. For an emitter follower amplifier, the voltage gain is :

(1) greater than unity (2) less than unity

(3) exactly unity (4) zero

211. A rectangle of cross sectional area A is placed in a uniform electric field. The normal to the area of the coil makes an angle of 90° with the electric field. The electric flux ϕ, through the rectangle is :

(1) E (2) 0 (3) A.E/$\sqrt{2}$ (4) A.E

212. Out of the following, which one is the consequence of the Maxwell's equation ?

(1) $D = \epsilon_0 E$ (2) $D = \epsilon_0 E + P$ (3) $B = \mu_0 H$ (4) $c\sqrt{\epsilon_0 \cdot \mu_0} = 1$

where symbols have their usual meanings.

213. For any operator A, $i\left(A^+ - A\right)$ is :

(1) Unitary (2) Anti-Hermitian

(3) Hermitian (4) Orthogonal

where i is an imaginary number.

214. Eigen values of the mattrix $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2i \\ 0 & 0 & 2i & 0 \end{pmatrix}$ are :

(1) $-2, -1, 1, 2$ (2) $-1, 1, 0, 2$ (3) $1, 0, 1, -2$ (4) $-1, 1, 0, 3$

215. If q_1 and q_2 are generalized coordinates and p_1 and p_2 are corresponding generalized momenta, then the Poisson bracket $\{q_1^2 + q_2^2, 2p_1 + p_2\}$ is :

(1) 0 (2) $(q_1^2 + q_2^2)p_1$ (3) $3(q_1^2 + q_2^2)$ (4) $2(q_1 + q_2)$

216. A system is described by the Lagrangian $L = \frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) - \frac{\alpha}{r}$ where α is a constant. Which one of the following statement is ***not*** true ?

(1) p_θ is conserved (2) p_r is conserved

(3) Total energy is conserved (4) θ is cyclic

217. The operator $\left(x\frac{d}{dx} - 1\right)^2$ is equal to

(1) $x^2\frac{d^2}{dx^2} - 2x\frac{d}{dx} + 1$ (2) $x^2\frac{d^2}{dx^2} + x\frac{d}{dx} + 1$

(3) $x^2\frac{d^2}{dx^2} - x\frac{d}{dx} + 1$ (4) $x^2\frac{d^2}{dx^2} - 1$

218. A free particle is moving in $+x$ direction with a linear momentum p. The wave function of the particle normalized in a length L is :

(1) $\frac{1}{\sqrt{L}}\sin\frac{p}{\hbar}x$ (2) $\frac{1}{\sqrt{L}}\cos\frac{p}{\hbar}x$ (3) $\frac{1}{\sqrt{L}}e^{\frac{-ipx}{\hbar}}$ (4) $\frac{1}{\sqrt{L}}e^{\frac{ipx}{\hbar}}$

219. Degeneracy of the first excited state of an isolated hydrogen atom is :

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

220. $\nabla^2 V = 4\pi\rho$ represents :

(1) Maxwell's equation (2) Poisson's equation

(3) Laplace's equation (4) Gauss law

221. An atom with singlet electronic states in placed in a weak magnetic field. The line due to the transition ${}^1D_2 - {}^1P_1$ will :

(1) split into 3 components of same polarization

(2) split into 9 components of same polarization

(3) split into 3 components of two different polarization

(4) split into 2 components of different polarization

222. Line width of a LASER light is 20 Hz. If $c = 3 \times 10^8$ m/s, the value of coherence length is :

(1) 15×10^5 km (2) 15×10^3 m (3) 15 m (4) 15×10^6 m

223. In a Fresnel biprism experiment on interference, if half of the biprism (one side of biprism edge) is covered with a semi-transparent sheet to reduce the amplitude of the transmitted light to half of its original value :

(1) the interference pattern will disappear

(2) the pattern will be formed with increased fringe contrast

(3) the pattern will be formed with visibility V = 0.8

(4) the pattern will be formed with visibility V = 1/3

224. A medium suitable for producing LASER radiation has been activated to the condition of population inversion. In this situation, the system :

(1) has positive temperature (in Kelvin)

(2) has negative temperature (in Kelvin)

(3) has temperature as 0°K

(4) may have positive and/or negative temperature (in Kelvin)

225. Which of the following is ***true*** ? ESR and NMR spectroscopies are related to :

(1) radio and microwave regions respectively

(2) radio and IR regions respectively

(3) microwave and radio wave regions respectively

(4) microwave and IR regions respectively

226. In molecule the energies involved in rotational (ΔE_r), vibrational (ΔE_v) and electronic (ΔE_e) transitions lie in :

(1) microwave, IR and VIS/UV regions respectively

(2) microwave, VIS/UV and IR regions respectively

(3) IR, microwave and VIS/UV regions respectively

(4) VIS/UV, IR and microwave regions respectively

227. The ground state of *He* atoms is :

(1) $^2S_{1/2}$ (2) $^4S_{3/2}$ (3) $^1S_0$ (4) $^3P_0$

228. ABABA ..... represents an arrangement of layers called :

(1) hexagonal closed packing (2) cubic closed packing

(3) body centered cubic packing (4) face centered cubic packing

229. In x-ray diffraction studies, x-rays are scattered by :

(1) Nucleus only (2) Protons only (3) Neutrons only (4) Electrons only

230. Which one of the following is ***not*** an example of intrinsic semiconductor ?

(1) *Si* (2) *Ge* (3) *Al* (4) *Sn*

231. Mobility of holes as compared to mobility of electrons in intrinsic semiconductor :

(1) equal (2) greater

(3) cannot be defined (4) less

232. According to Hall effect, if a conducting material is placed in a uniform magnetic field and a current is passed, a voltage is found to develop at :

(1) parallel to the current (2) parallel to the magnetic field

(3) perpendicular to the magnetic field (4) perpendicular to the current

233. The average life time of a nucleus is related with decay constant λ as :

(1) λ (2) $1/\lambda$ (3) $\lambda \ln 2$ (4) $2 \ln \lambda$

234. The surface energy term of liquid drop models is **proportional** to :

(1) A (2) $A^{2/3}$ (3) $A^{1/3}$ (4) $A^{3/4}$

P.T.O.

235. Complete the fusion relation :

$D + {}^3He_2 \rightarrow {}^4He_2 + ...$

(1) $2p$ (2) n (3) p (4) $3n$

here, D is the deuteron.

236. The Poynting vector S of an electromagnetic wave is :

(1) $S = E \times B$ (2) $S = E \times H$ (3) $S = E/H$ (4) $S = E/B$

where symbols have their usual meaning.

237. The dimensions of action are :

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

238. A 2×2 matrix has determinant 1 and trace 2. Its eigen values are :

(1) ± 1 (2) 0, 1 (3) 1, 1 (4) 0, 2

239. In a diffraction experiment (of Fraunhoffer type) with a simple slit if the wavelength of the light used is equal to the slit-width, which of the statements is ***true*** ?

(1) Diffraction pattern disappears

(2) The central maximum fills the entire screen

(3) Theory used becomes invalid

(4) The pattern is unaffected

240. Coupling of orbital and spin motions of electron gives rise to :

(1) Zeeman effect (2) Stark effect

(3) Hyperfine splitting (4) Fine splitting

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण-पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल ***नीली/काली बाल-प्वाइंट पेन*** से ही लिखे)

1. प्रश्न-पुस्तिका मिलने के 10 मिनट के अन्दर ही देख लें कि प्रश्न-पुस्तिका में सभी पृष्ठ मौजूद है और कोई प्रश्न छूटा नहीं है। प्रश्न-पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में ***लिफाफा रहित प्रवेश-पत्र के अतिरिक्त,*** लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. उत्तर-पत्र अलग से दिया गया है। ***इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा। केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।***
4. अपना ***अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से*** निर्धारित स्थान पर लिखें।
5. ***उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।***
6. ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्न-पुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्न-पुस्तिका पर अनुक्रमांक संख्या और ओ० एम० आर० पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।
7. उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।
8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। ***प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिये आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।***
9. प्रत्येक प्रश्न के उत्तर के लिये केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ***ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है।*** यदि आप किसी प्रश्न का ***उत्तर नहीं देना चाहते हैं,*** तो सम्बन्धित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।
11. रफ कार्य के लिये इस प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा अंतिम खाली पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त ***केवल ओ० एम० आर० उत्तर-पत्र*** ही परीक्षा भवन में जमा करें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की भागी होगा/होगी।