

Msc (Bioinformatics)

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Question Booklet No.....

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

Roll No.

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Roll No.

(Write the digits in words)

Serial No. of OMR 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 also Roll No. and OMR Sheet No. on the Question Booklet.
7. Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.
8. Each question in this 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 ball-point 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 mark).
11. For rough work, use the inner back page of the title cover and the blank page at the end of this 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 गए हैं।]

[No. of Printed Pages : 36+2]



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No. of Questions/प्रश्नों की संख्या : 150

Time/समय : 2½ Hours/घण्टे

Full Marks/पूर्णांक : 450

- Note :**
- (1) This paper comprises of Two Sections, viz., Section—A and Section—B having 30 Multiple Choice Questions in Section—A, and 120 Multiple Choice Questions in Section—B comprising 40 questions of Biology, 40 questions of Chemistry and 40 questions of Physics. A candidate has to attempt all **150** questions.
 - (2) 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.
 - (3) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

Section—A

1. In Java for an array having N elements, legal subscripts are

- (1) 0 to N (2) 0 to $N - 1$ (3) 1 to N (4) 1 to $N - 1$

2. Total size of array A having 25 elements of char type is

- (1) 25 bytes (2) 50 bytes (3) 100 bytes (4) 150 bytes

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3. A class encapsulates

- (1) data
- (2) method
- (3) functionality
- (4) All of the above

4. If a local variable is having the same name as that of a global class element, then it

- (1) hides the global variable
- (2) gets hidden by global variable
- (3) produces an error
- (4) None of the other

5. Which of the following is not a legal programming construct?

- (1) Sequence
- (2) Selection
- (3) Iteration
- (4) Jumping

6. Which clause is optional in a switch statement?

- (1) Switch
- (2) Case
- (3) Default
- (4) None of the above

7. A package is a collection of

- (1) classes
- (2) interface
- (3) editing tools
- (4) classes and interfaces

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8. The parameters appearing in definition are called
- (1) actual parameters (2) formal parameters
(3) call parameters (4) All of the above
9. Which keyword turns a variable declaration into constant declaration?
- (1) Const (2) Constant (3) Final (4) Fixed
10. Java applications are
- (1) very big (2) very small
(3) platform independent (4) platform dependent
11. A and B are friends. Ignoring the leap year, the probability of both friends will have different birthday is
- (1) $\frac{1}{365}$ (2) $\frac{364}{365}$ (3) $\frac{3}{365}$ (4) $\frac{6}{365}$

12. The mean of the following data :

<i>Class interval</i>	0-10	10-20	20-30	30-40	40-50
<i>Frequency</i>	10	6	8	12	5

is

- (1) $24\frac{1}{41}$ (2) $\frac{1}{41}$ (3) $4\frac{1}{41}$ (4) $20\frac{5}{41}$

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13. The median of 7, 12, 15, 6, 20, 8, 4 and 10 is
- (1) $\frac{41}{4}$ (2) 8 (3) 9 (4) 6
14. For
9, 11, 15, 19, 17, 13, 7
9 is
- (1) lower quartile (2) upper quartile
(3) inter-quartile (4) None of the above
15. Mode of 4, 7, 4, 3, 2, 7, 7, 6, 4, 7, 8 is
- (1) 4 (2) 6 (3) 7 (4) 8
16. 23 is mean of 11 numbers. If 5 is added to each 11 numbers, then new mean will be
- (1) 28 (2) 16 (3) 34 (4) 29
17. 33 is median of 17, 26, 60, 45, 33. If 27 is taken in place of 17, then new median will be
- (1) 23 (2) 33 (3) 38 (4) 43
18. Two dice are rolled simultaneously. The probability of obtaining a total of at least 9 is
- (1) $\frac{11}{36}$ (2) $\frac{1}{3}$ (3) $\frac{5}{18}$ (4) $\frac{1}{2}$

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19. Two dice are thrown simultaneously. The probability that the product of the numbers on the dice is 8, is

- (1) $\frac{1}{6}$ (2) $\frac{2}{3}$ (3) $\frac{1}{9}$ (4) $\frac{1}{18}$

20. Inter-quartile range of following frequency distribution

<i>Class interval</i>	5-10	10-15	15-20	20-25	25-30	30-35
<i>Frequency</i>	3	4	6	9	7	1

is

- (1) 15.5 (2) 20.5 (3) 10 (4) 10.5

21. A vertical pole and a vertical tower are on the same level ground. From the top of the pole the angle of elevation of the top of the tower is 60° and the angle of depression of the foot of the tower is 30° . If 20 metres is height of pole, then height of the tower will be

- (1) 30 metres (2) 60 metres (3) 80 metres (4) 90 metres

22. If $a + b + c \neq 0$, equations

$$-2x + y + z = a$$

$$x - 2y + z = b$$

$$x + y - 2z = c$$

- (1) are consistent (2) are inconsistent
 (3) have unique solution (4) have infinitely many solutions

23. The value of determinant

$$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix}$$

is

- (1) $4a^4b^4c^4$ (2) $(b-1)^3(c-1)^3(a-1)^3$
 (3) $(a+b+c+3)(a-1)^3$ (4) $2abc(a+b+c)^3$

24. The equation of plane through point $(2, -3, 1)$ and perpendicular to the line of intersection of the planes $3x - y + z + 1 = 0$ and $5x + y + 3z = 0$ is

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

25. A metallic sphere of radius 10.5 cm is melted and then recast into small cones each of radius 3.5 cm and height 3 cm. Number of cones thus formed is

- (1) 105 (2) 126 (3) 100 (4) 95

26. If α and β are the roots of the equation $(x - a)(x - b) = c$, $c \neq 0$, then roots of equation $(x - \alpha)(x - \beta) + c = 0$ are

- (1) a, c (2) b, c
 (3) a, b (4) $(a + c), (b + c)$

27. Let a, b, c be distinct non-negative numbers. If vectors $a\vec{i} + a\vec{j} + c\vec{k}$, $\vec{i} + \vec{k}$, $c\vec{i} + c\vec{j} + b\vec{k}$ lie in a plane, then c is

- (1) the arithmetic mean of a and b
 (2) the geometric mean of a and b
 (3) the harmonic mean of a and b
 (4) equal to zero

28. Let n be a positive integer. If the coefficients of second, third and fourth terms in the expansion of $(1+x)^n$ are in arithmetic progression, then value of n will be

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

29. If

$$\int_0^x f(t) dt = x + \int_x^1 tf(t) dt$$

value of $f(1)$ will be

- (1) $\frac{1}{2}$ (2) 0 (3) 1 (4) $-\frac{1}{2}$

30. Solution of differential equation

$$x(x-1) \frac{dy}{dx} - y = x^2(x-1)^2$$

will be

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

Section—B

BIOLOGY

31. The sum total of all the genes and their alleles present in a population means

- (1) genetic recombination (2) gene pool
(3) gene conversion (4) gene bank

32. Which one of the following is sex linked inheritance?

- (1) Haemophilia (2) Influenza (3) Diabetes (4) Tuberculosis

33. Interferons are

- (1) antiviral proteins (2) antibacterial proteins
(3) anticancer proteins (4) anti HIV proteins

34. Hallucinogenic drug is

- (1) opium (2) caffeine (3) morphine (4) LSD

35. A hybrid is usually superior in one or more traits than either parent. This trait is called

- (1) polyploidy (2) hybrid vigour
(3) hybridization (4) aneuploidy

36. Important free living nitrogen fixing bacterium in soil is
(1) *Clostridium* (2) *Rhizobium* (3) *Azospirillum* (4) *Nostoc*
37. Homeostasis helps a living system in maintaining
(1) constant external environments
(2) constant internal environments
(3) osmoregulation
(4) feedback mechanisms
38. Verticillaster inflorescence is present in
(1) Asteraceae (2) Lamiaceae
(3) Asclepiadaceae (4) Ranunculaceae
39. Double fertilization and triple fusion occurs in
(1) bryophytes (2) pteridophytes
(3) gymnosperms (4) angiosperms
40. The gritty thick walled sclerenchymatous cells present in the seed coat of some pulses are
(1) aerenchyma cells (2) parenchyma cells
(3) collenchyma cells (4) stone cells

41. Rapid multiplication of valuable plant material for agriculture, horticulture and forestry is called

- (1) vegetative propagation (2) grafting
(3) layering (4) micropropagation

42. Totality of structures enclosed by the endodermis is called

- (1) vascular bundle (2) stele
(3) bark (4) cork

43. Heterospory and seed habit originated in

- (1) pteridophytes (2) bryophytes
(3) angiosperms (4) gymnosperms

44. Which one of the following statements is not correct for recombinant DNA technology?

- (1) Isolation of a useful DNA segment
(2) Inserting the segment into a suitable vector
(3) Production of only a single copy of recombinant DNA
(4) Inserting altered DNA into a appropriate organism

45. Which one is not the purpose of biosphere reserves?
- (1) Conservation
 - (2) Development
 - (3) Scientific research, monitoring and education
 - (4) Introduction of exotic species
46. Which one of the following is not a growth regulatory substance?
- (1) Auxins
 - (2) Gibberellins
 - (3) Ethylene
 - (4) Ascorbic acid
47. The transfer of energy from one trophic level to next trophic level is called
- (1) calorific value
 - (2) food chain
 - (3) nutrient mobilisation
 - (4) gross primary productivity
48. During glycolysis glucose is converted into pyruvic acid. How much is the gain of ATP molecules in this process?
- (1) 16
 - (2) 8
 - (3) 24
 - (4) 34
49. Tumour inducing plasmid occurs in
- (1) *Agrobacterium tumefaciens*
 - (2) *Bacillus thuringiensis*
 - (3) *Bacillus subtilis*
 - (4) *Azotobacter aerogenes*

50. Aflatoxins were first reported from
- (1) *Aspergillus flavus* (2) *Penicillium notatum*
(3) *Helminthosporium oryzae* (4) *Trichoderma viride*
51. In mammals, total number of cervical vertebra is
- (1) 10 (2) 12 (3) 7 (4) 5
52. Which one of the following is exclusively marine?
- (1) Echinoderms (2) Sponges (3) Molluscs (4) Polychaetes
53. Which one of the following has lowest Basal Metabolic Rate?
- (1) Fishes (2) Birds (3) Reptiles (4) Mammals
54. The vector of 'Black-fever' (kala-azar) is
- (1) Housefly (2) Sandfly (3) Anopheles (4) Aedes
55. The largest animal ever to have lived on Earth is
- (1) Dinosaur (2) African Elephants
(3) Giraffe (4) Blue Whales
56. Galactose is a
- (1) triose sugar (2) tetrose sugar
(3) pentose sugar (4) hexose sugar

- 57.** Folding of the alpha helix into a variety of shapes produces tertiary structure of the protein. The structure is maintained by
- (1) hydrogen bond (2) carbon bond
(3) oxygen bond (4) carboxyl group
- 58.** The coenzyme NAD (Nicotinamide Adenine Dinucleotide) is formed from
- (1) niacine (2) phosphoglyceraldehyde
(3) phosphoglyceric acid (4) pyruvic acid
- 59.** Egg production in mammalian ovary is arrested by suppression of
- (1) FSH (2) LH
(3) estrogen (4) progesterone
- 60.** The outermost membrane of the embryo is called
- (1) amnion (2) chorion (3) placenta (4) decidua
- 61.** Surrounding the heart is a double walled sac known as
- (1) peritoneum (2) pericardium (3) pleura (4) myocardium
- 62.** Which of the following statements is incorrect?
- (1) Plasma contains fibrin
(2) Serum contains fibrin
(3) Fibrin helps in blood clotting
(4) Vitamin K is one of the clotting factors

- 63.** ADH or vasopressin is produced by
- (1) hypothalamus (2) pituitary
(3) cortex of kidney (4) medulla of kidney
- 64.** Which of the statements is not correct?
- (1) The cornea and lens of the eye focus the light to the fovea
(2) Cones are absent in fovea
(3) Rods are absent in fovea
(4) Fovea is the region of keenest vision
- 65.** The structural and functional unit of nature is called
- (1) population (2) community (3) ecosystem (4) environment
- 66.** Minamata disease was caused due to
- (1) mercury (2) cadmium
(3) zinc (4) polychlorinatedbiphenyls
- 67.** Who discovered DDT as an insecticide?
- (1) Paul Muller (2) Othmar Zeidler
(3) Robert Wallace (4) Hargobind Khorana

68. Which one is a greenhouse gas?

- | | |
|--------------------|--------------|
| (1) Oxygen | (2) Hydrogen |
| (3) Carbon dioxide | (4) Nitrogen |

69. Study of insects is called

- | | |
|-----------------|-------------------|
| (1) Entomology | (2) Parasitology |
| (3) Ichthyology | (4) Palaeontology |

70. Which one of the following is 'blood worm'?

- | | |
|------------------|----------------|
| (1) Tubifex | (2) Chironomus |
| (3) Trypanosomes | (4) Entamoeba |

CHEMISTRY

71. The species that are aromatic according to Hückel's rule are



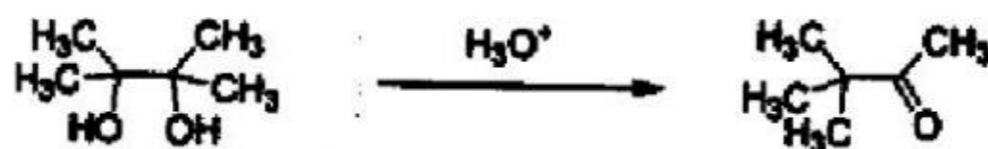
- (1) (A) and (B) (2) (A) and (C) (3) (B) and (D) (4) (B) and (C)

72. The correct order acid strength of the compounds (A) to (D) is



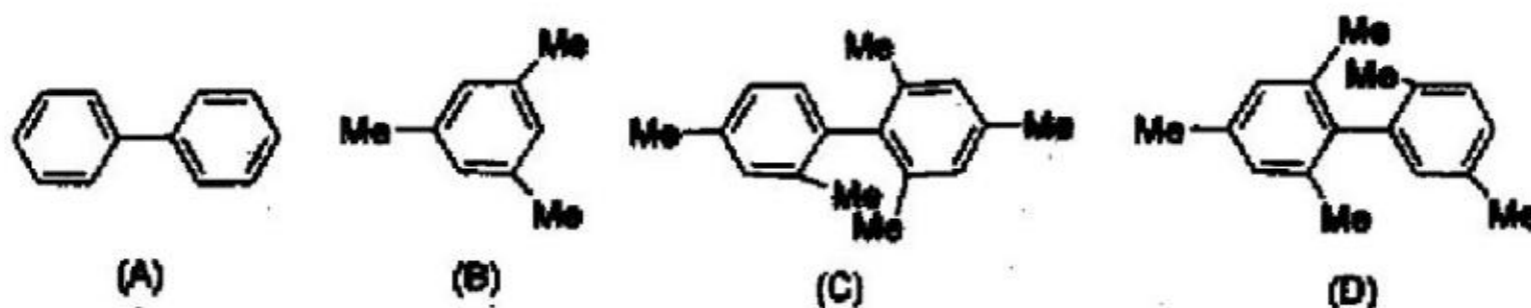
- (1) (A) > (B) > (C) > (D) (2) (D) > (B) > (C) > (A)
 (3) (A) > (D) > (C) > (B) (4) (D) > (A) > (B) > (C)

73. The following reaction is an example of



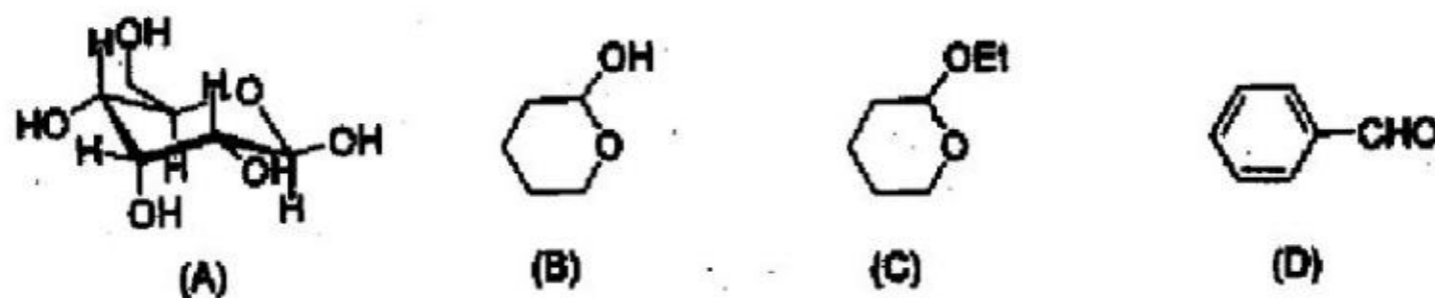
- (1) oxidation (2) reduction
 (3) disproportionation (4) neither oxidation nor reduction

74. Of the following compounds, the odd-man in respect of λ_{\max} in the UV spectra is



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

75. Which of the following compounds will not respond to Tollens' test?



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

76. Which of the following is a miss-matched pair?

- (1) LPG— C_3H_8
 (2) Picric acid— C_6H_5OH
 (3) Vinegar— CH_3CO_2H
 (4) Paracetamol—4-HOC₆H₄NHCOCH₃

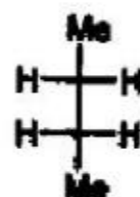
77. Which of the following compounds is/are *meso*-isomers?



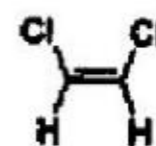
(A)



(B)



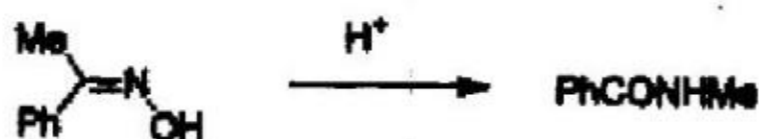
(C)



(D)

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

78. Regarding the following reaction, which statement is true?



- (1) The reaction is stereospecific
 (2) The reaction follows a stereospecific path
 (3) The reaction is intramolecular
 (4) The reaction is an example of Hoffmann rearrangement
79. Pick out the correct statement.

In stationary state

- (1) potential energy is independent of time
 (2) potential energy depends on time
 (3) potential energy depends both on time and space
 (4) probability density of the particle depends on time



80. Arrange the following compounds according to their increasing boiling point :

(A) CH_4 (B) NH_3 (C) H_2O (D) HF

(1) (A) < (B) < (C) < (D)

(2) (D) < (C) < (B) < (A)

(3) (A) < (B) < (D) < (C)

(4) (B) < (A) < (D) < (C)

81. Shape of IF_5 is

(1) trigonal bipyramid

(2) square pyramid

(3) pentagonal planar

(4) octahedral

82. Dipole moment of nitrobenzene is 3.93 D. Dipole moment of *m*-dinitrobenzene is

(1) 3.4 D

(2) 3.93 D

(3) 6.81 D

(4) 7.86 D

83. Which of the following compounds is IR inactive?

(1) SO_2

(2) H_2O

(3) HCl

(4) H_2

84. The radiative transition is

(1) fluorescence

(2) internal crossing

(3) inter-system crossing

(4) collisional deactivation

85. Total number of signals in the ^1H NMR spectrum of CH_3CHO is

(1) 2

(2) 4

(3) 5

(4) 6

91. Which of the following solutions would not act as buffer?

- (1) $\text{CH}_3\text{COONH}_4$ (2) $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$
(3) conc. HCl (4) $\text{Na}_2\text{SO}_4 + \text{NaOH}$

92. In an ideally dilute solution, solvent obeys

- (1) Henry's law (2) Raoult's law (3) Charles' law (4) Boyle's law

93. Pick out the wrong statement. For a given reaction

- (1) equilibrium constant depends on pressure
(2) equilibrium constant depends on stoichiometric representation of the reaction
(3) equilibrium constant depends upon standard state of reactants and products
(4) equilibrium constant depends on temperature

94. For the reaction $\text{N}_2(g) + 2\text{H}_2(g) = 2\text{NH}_3(g)$, if total pressure upon the reaction mixture increases

- (1) reaction mixture will explode
(2) yield will increase
(3) yield will decrease
(4) yield will remain same



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95. In osmosis, through the semipermeable membrane

- (1) solution passes
- (2) solvent passes from pure solvent to solution
- (3) only solute passes from solution to pure solvent
- (4) only solvent passes from the solution to pure solvent

96. Which one of the following is true for a cyclic change?

- (1) $\Delta G < 0$, $\Delta S > 0$, $\Delta H = \Delta U = 0$
- (2) $Q = W = \Delta U = \Delta H = 0$, $\Delta S \neq 0$
- (3) $\Delta G = \Delta S = \Delta H = \Delta U = 0$
- (4) $\Delta G = \Delta U = \Delta S = \Delta H = 0$, $Q = W \neq 0$

97. ΔH and ΔU are path independent quantities. W and Q are path dependent quantities. Therefore

- (1) $\Delta H = \Delta U = Q_v$
- (2) $\Delta H \neq \Delta U$
- (3) path independent quantities can be equal to path dependent quantities
- (4) $\Delta H = \Delta U = Q_p$

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98. ΔS for a process for any substance is given by one of the following forms

$$(1) \Delta S = nC_p \ln \frac{T_2}{T_1} + nR \ln \frac{V_2}{V_1}$$

$$(2) \Delta S = n \int C_p \frac{dT}{T} + \left(\frac{\partial P}{\partial T} \right)_V dV$$

$$(3) \Delta S = nC_p \frac{dT}{T} + R \frac{dV}{V}$$

$$(4) \Delta S = \frac{Q_{rev}}{T} = \int nC_p \frac{dT}{T} - \int \left(\frac{\partial V}{\partial T} \right)_P dP$$

99. Suppose for the reaction $A = B$, $\Delta G > 0$

(1) A will never be completely converted to B

(2) B will not be converted to A

(3) All reactions are not reversible. Hence B will be completely converted to A

(4) Both the reactions $A \rightarrow B$ and $B \rightarrow A$ will take place, since all reactions are reversible and there will be equilibrium mixture of A and B as the final state

100. The number of stereoisomers of the complex $[MA_2B_2C_2]$, where M is a metal and A, B and C are monodentate ligands is

(1) 5

(2) 6

(3) 11

(4) 12

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101. An example of hexadentate ligands are

- (1) 2,2'-dipyridyl
- (2) ethylenediammine (en)
- (3) imidodiacetate
- (4) ethylenediamminetetra-acetic acid

102. Which of the metals below forms a large number of complexes in both +2 and +3 state and is the first complex discovered by a German dye maker Diesbach?

- (1) Fe
- (2) Co
- (3) Ni
- (4) Cu

103. According to IUPAC nomenclature of organic complexes (2007), the name of the complex $[\text{CoCl}_2(\text{NH}_3)_4]\text{Cl}$ is

- (1) tetra-amminedichlorocobalt (III) chloride
- (2) tetra-amminedichloridocobalt (III) chloride
- (3) dichlorotetra-amminecobalt (III) chloride
- (4) dichloridotetra-aminecobalt (III) chloride

104. A catalyst

- (1) can initiate a reaction
- (2) reduces activation energy of all the paths leading to several products from the same reactant
- (3) reduces activation energy of only a specific path of all the possible paths leading to several products from the same reactant
- (4) can affect the position of equilibrium of a reaction

105. Pick out the correct statement

- (1) Both order and molecularity of a reaction are experimental quantities
- (2) Order is an experimental quantity but molecularity is a theoretical concept
- (3) Both order and molecularity of a reaction are theoretical concept
- (4) Both order and molecularity of a reaction can be negative or positive

106. Which cannot be a stationary phase in column chromatography?

- (1) Silica gel (2) Naphthalene (3) Charcoal (4) Alumina

107. Which of the following statements is false?

- (1) Both ionization potential and electrode potential must have the same unit since both are related to electron transfer
- (2) The maximum number of electrons that can be accommodated in F orbital is 14
- (3) If I and A represent ionization potential and electron affinity respectively, then electronegativity, $E = \frac{1}{2}(I + A)$
- (4) If 54 g of water is taken in a beaker, then the amount of matter according to SI system = $\frac{0.054 \text{ kg}}{0.018 \text{ kg mole}^{-1}}$ mole

108. If the radius ratio of positive and negative ions is $\frac{r_+}{r_-} = 0.78$, then the coordination number of positive ion is

- (1) 8 (2) 6 (3) 5 (4) 4

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(P.T.O.)



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109. There are some naturally occurring elements in the periodic table which were initially synthesized because their presence in earth's crust is very small. The number of such elements is

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

110. The name of the first and last Actinides are

- (1) La and Lu (2) Th and Es (3) Ac and Lr (4) Np and Rf

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PHYSICS

- 111.** When a projectile is at the highest point of its trajectory, the direction of its velocity and acceleration are
- (1) parallel to each other
 - (2) anti-parallel to each other
 - (3) inclined to each other at an angle of 45°
 - (4) 90° to each other
- 112.** The equation of motion of a projectile is $y = ax - bx^2$, where a and b are constants of motion. The horizontal range of the projectile is
- (1) $\frac{a}{b}$
 - (2) $\frac{b}{a}$
 - (3) $\frac{a^2}{2b^2}$
 - (4) $\frac{b^2}{2a^2}$
- 113.** A solid cylinder of mass M and radius R rolls down an inclined plane of height h . The angular velocity of the cylinder when it reaches the bottom of the plane will be
- (1) $\frac{2}{R} \sqrt{gh}$
 - (2) $\frac{2}{R} \sqrt{\frac{gh}{2}}$
 - (3) $\frac{2}{R} \sqrt{\frac{gh}{3}}$
 - (4) $\frac{1}{2R} \sqrt{gh}$
- 114.** Time period of a simple pendulum is $T \propto m^a l^b g^c$, where m is the mass of the bob, l is the length of the string and g is the gravitational acceleration. The values of a , b and c are
- (1) $0, \frac{1}{2}, -\frac{1}{2}$
 - (2) $0, -\frac{1}{2}, \frac{1}{2}$
 - (3) $\frac{1}{2}, 0, -\frac{1}{2}$
 - (4) $-\frac{1}{2}, 0, \frac{1}{2}$

115. A satellite is orbiting the earth in a circular orbit of radius r . Its period of revolution varies as
- (1) \sqrt{r} (2) r (3) r^2 (4) $r^{3/2}$
116. A Carnot's engine whose sink is at a temperature of 300 K has an efficiency of 40%. By how much should the temperature of the source be increased so as to increase the efficiency to 60%?
- (1) 250 K (2) 275 K (3) 300 K (4) 325 K
117. Work W is required to be done to form a spherical bubble of volume V from a given soap solution. How much work is needed to form a spherical bubble of volume $2V$?
- (1) $2W$ (2) $\sqrt{2}W$ (3) $^{1/3}W$ (4) $^{2/3}W$
118. An ideal gas at pressure P is adiabatically compressed so that its density becomes n times the initial value. The final pressure of the gas will be $\left(\gamma = \frac{C_p}{C_v}\right)$
- (1) $n^{(\gamma-1)}P$ (2) $n^{-\gamma}P$ (3) $n^\gamma P$ (4) $n^{(1-\gamma)}P$
119. A vertical glass tube, closed at the bottom, contains a mercury column of length L_0 at 0°C . If γ is the coefficient of cubical expansion of mercury and α is the coefficient of linear expansion of glass, the length of the mercury column when the temperature rises to $t^\circ\text{C}$ is (assuming that t is not more than 100°C)
- (1) $L_t = L_0 [1 + (\gamma - 3\alpha) t]$ (2) $L_t = L_0 [1 + (\gamma + 3\alpha) t]$
 (3) $L_t = L_0 [1 + (\gamma + 2\alpha) t]$ (4) $L_t = L_0 [1 + (\gamma - 2\alpha) t]$

120. A sphere, a cube and a thin circular plate have the same mass and are made of the same material. All of them are heated to the same temperature. The rate of cooling is

- (1) the maximum for the sphere and minimum for the circular plate
- (2) the maximum for the sphere and minimum for the cube
- (3) the maximum for the circular plate and minimum for the sphere
- (4) the same for all the three

121. Consider a three-dimensional vector field $\mathbf{V}(x, y, z)$ such that $\nabla \cdot \mathbf{V} = s$ and $\nabla \times \mathbf{V} = \vec{c}$, where s and c are, respectively, source and circulation densities in a finite region of space. Now if \mathbf{V} has non-zero s and but zero \vec{c} , then \mathbf{V} is derivable from

- (1) a vector field
- (2) a scalar field
- (3) neither a scalar field nor a vector field
- (4) None of the above

122. A body of mass m_1 moving at a constant speed undergoes an elastic collision with a body of mass m_2 initially at rest. The ratio of kinetic energy of mass m_1 after the collision to that before the collision is

$$(1) \left(\frac{m_1 - m_2}{m_1 + m_2} \right)^2 \quad (2) \left(\frac{m_1 + m_2}{m_1 - m_2} \right)^2 \quad (3) \left(\frac{2m_1}{m_1 + m_2} \right)^2 \quad (4) \left(\frac{2m_2}{m_1 + m_2} \right)^2$$

123. An enclosure of volume V contains a mixture of 8 g of oxygen, 14 g of nitrogen and 22 g of carbon dioxide at absolute temperature T . The pressure of the mixture of gasses is (R is the universal gas constant)
- (1) $\frac{RT}{V}$ (2) $\frac{3RT}{2V}$ (3) $\frac{5RT}{4V}$ (4) $\frac{7RT}{5V}$
124. The displacement of a particle in a simple harmonic motion is given as $A \sin(\omega t + \phi)$, where A , ω and ϕ are three constants characterize the simple harmonic motion. The velocity of the particle in simple harmonic motion is
- (1) $\omega \sqrt{x^2 - A^2}$ (2) $\omega \sqrt{A^2 - x^2}$ (3) ωx (4) $-\omega x$
125. An electric dipole placed with its axis in the direction of a uniform electric field experiences
- (1) a force but no torque
 (2) a torque but no force
 (3) a force as well as a torque
 (4) neither a force nor a torque
126. A cube of side b has a charge q at each of its vertices. What is the electric potential at the centre of the cube?
- (1) $\frac{4q}{\sqrt{3}\pi\epsilon_0 b}$ (2) $\frac{\sqrt{3}q}{\pi\epsilon_0 b}$ (3) $\frac{2q}{\pi\epsilon_0 b}$ (4) 0

127. A particle of mass m and charge q is moving with a velocity $\vec{v} = (3\hat{i} + 2\hat{j})$ m/s in a magnetic field $\vec{B} = (2\hat{j} + 2\hat{k})$ tesla. Force exerted on the charge particle is

- (1) $3q(2\hat{i} - 3\hat{j} - 2\hat{k})$ newton (2) $3q(-2\hat{i} + 3\hat{j} - 2\hat{k})$ newton
 (3) $3q(2\hat{i} - 3\hat{j} + 2\hat{k})$ newton (4) $3q(2\hat{i} + 3\hat{j} - 2\hat{k})$ newton

128. A proton and an alpha particle are projected perpendicular to a uniform magnetic field with equal velocities. If r_p and r_α are the respective radii of their circular path, then the ratio $\frac{r_p}{r_\alpha}$ is

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

129. In series LCR circuit, the voltage in the circuit lags the current if

- (1) $\omega = \frac{1}{\sqrt{LC}}$ (2) $\omega > \frac{1}{\sqrt{LC}}$ (3) $\omega < \frac{1}{\sqrt{LC}}$ (4) $\omega < \sqrt{\frac{L}{C}}$

130. Which of the following pairs of space and time varying $\mathbf{E} (= \hat{i}E_x + \hat{j}E_y + \hat{k}E_z)$ and $\mathbf{B} (= \hat{i}B_x + \hat{j}B_y + \hat{k}B_z)$ would generate a plane electromagnetic wave travelling in the z -direction?

- (1) E_x, B_z (2) E_y, B_z (3) E_x, B_x (4) E_x, B_y

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131. The ratio of the radii of the nuclei ${}_{13}\text{A}^{27}$ and ${}_{52}\text{A}^{125}$ is
(1) 3:5 (2) 13:52 (3) 27:125 (4) 2:3
132. The X-ray beam coming from an X-ray tube is
(1) monochromatic
(2) having all wavelengths smaller than a certain maximum wavelength
(3) having all wavelengths longer than a certain minimum wavelength
(4) having all wavelengths between a minimum and a maximum wavelength
133. The Germanium semiconductor has an energy gap between the valence and the conduction band is
(1) 1.1 eV (2) 0.3 eV (3) 1.4 eV (4) 0.7 eV
134. Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time
(1) λ (2) $\frac{1}{2\lambda}$ (3) $\frac{1}{4\lambda}$ (4) $\frac{e}{\lambda}$
135. The binding energy per nucleon is almost same for many nuclei. It indicates that the nuclear forces are
(1) attractive (2) short range
(3) charge independent (4) saturated

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136. A point charge is kept at a distance $x = d$ from the origin $x = 0$. The charge distribution at d is
 (1) $q\delta(x)$ (2) $q\delta(x-d)$ (3) $q\delta(x+d)$ (4) $q\delta(x+2d)$
137. An intrinsic semiconductor is made up of N silicon atoms. The number of electrons can be accommodated in $2p$ energy band is
 (1) $2N$ (2) $4N$ (3) $6N$ (4) $10N$
138. The width of the depletion region of a junction diode under reverse bias
 (1) decreases
 (2) increases
 (3) first decreases then increases
 (4) first increases then decreases
139. The de Broglie wavelength of a particle, λ and its kinetic energy, K is related as
 (1) $\lambda \propto K$ (2) $\lambda \propto \sqrt{K}$ (3) $\lambda \propto \frac{1}{K}$ (4) $\lambda \propto \frac{1}{\sqrt{K}}$
140. The transistor configuration that generates highest voltage gain is
 (1) common-base (2) common-collector
 (3) common-emitter (4) same in all



141. The angle of minimum deviation of a prism is 30° and the angle of a prism is 60° . The refractive index of the prism material is
- (1) 2 (2) $\sqrt{2}$ (3) $\frac{3}{2}$ (4) $\frac{3}{\sqrt{2}}$
142. Two electric bulbs marked 25 W-220 V and 100 W-220 V are connected in series to a 440 V supply. Which of the bulbs will fuse?
- (1) Both (2) 100 W (3) 25 W (4) Neither
143. A beam of electron is used in Young's double-slit experiments. If the speed of electron is increased, then the fringe width will
- (1) decrease (2) increase
(3) remain same (4) Fringes will not be seen
144. When two light nuclei of masses M_1 and M_2 combine to form a nucleus of mass M , energy is emitted. In this process
- (1) $M_1 + M_2 < M$ (2) $M_1 + M_2 > M$
(3) $M_1 + M_2 = M$ (4) $M_1 + M_2 M^2$
145. In a common-emitter amplifier, the current-gain is
- (1) $\frac{\Delta i_C}{\Delta i_B}$ (2) $\frac{\Delta i_E}{\Delta i_B}$ (3) $\frac{\Delta i_B}{\Delta i_C}$ (4) $\frac{\Delta i_C}{\Delta i_E}$

146. In which of the following cases will the liquid flow in a pipe be most streamlined?

- (1) Liquid of high viscosity and high density flowing through a pipe of small radius
- (2) Liquid of high viscosity and low density flowing through a pipe of small radius
- (3) Liquid of low viscosity and low density flowing through a pipe of large radius
- (4) Liquid of low viscosity and high density flowing through a pipe of large radius

147. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combination is

- (1) $\sqrt{\frac{f_1}{f_2}}$
- (2) $\sqrt{\frac{f_2}{f_1}}$
- (3) $\frac{f_1 + f_2}{f_1}$
- (4) $\frac{f_1 + f_2}{f_1 f_2}$

148. A body is executing simple harmonic motion. At a displacement x , its potential energy is E_1 and at a displacement y , its potential energy is E_2 . The potential energy E at a displacement $(x + y)$ is

- (1) $E_1 + E_2$
- (2) $\sqrt{E_1^2 + E_2^2}$
- (3) $E_1 + E_2 + 2\sqrt{E_1 E_2}$
- (4) $\sqrt{E_1 E_2}$

149. If a gas has f degrees of freedom, the ratio $\frac{C_p}{C_v}$ of the gas is

- (1) $\frac{1+f}{2}$
- (2) $1 + \frac{f}{2}$
- (3) $\frac{1}{2} + f$
- (4) $1 + \frac{2}{f}$



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150. The energy of the electron of hydrogen orbiting in a stationary orbit of radius r_n is proportional to

(1) r_n

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

(3) r_n^2

(4) $\frac{1}{r_n^2}$

अभ्यर्थियों के लिए निर्देश

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

1. प्रश्न पुस्तिका मिलने के 10 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी 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 सं० और ओ० एम० आर० पत्र सं० 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 सून्य अंक दिये जायेंगे।
11. रफ़ कार्य के लिये प्रश्न-पुस्तिका के मुखपृष्ठ के अन्दर वाले पृष्ठ तथा अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ओ० एम० आर० उत्तर-पत्र परीक्षा भवन में जमा कर दें।
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।