

**Booklet Code : A**

**ENTRANCE EXAMINATION – 2017**

**M.Sc. (5-Year Integrated) Sciences**

(Mathematical Sciences, Physics, Chemical Sciences, Systems Biology and Earth Sciences)

Time : 2 Hours

Max. Marks : 100

**Hall Ticket Number :**

**INSTRUCTIONS**

**Please read the following instructions carefully :**

1. (a) Write your Hall Ticket Number in the above box AND on the OMR Sheet.  
(b) Fill in the OMR Sheet, the **Booklet Code** given above at the top right corner of this sheet. Candidates should also read and follow the other instructions given in the OMR sheet.
2. All answers should be marked clearly in the OMR answer sheet only.
3. There are 100 questions in this paper. Questions 1-25 are in Biology, 26-50 are in Chemistry, 51-75 are in Mathematics and 76-100 are in Physics.
4. **There is negative marking.** Every correct answer carries **1 (one) mark** and for every wrong answer **0.33 mark. Each question has only one correct option.**
5. The appropriate answer(s) should be coloured with either a blue or a black ball point or a sketch pen. **DONOT USE A PENCIL.**
6. Hand over the **OMR answer sheet** at the end of the examination to the Invigilator.
7. Use of non-programmable calculator and log-tables is allowed.
8. Use of mobile phone is **NOT** allowed inside the hall.
9. No additional sheets will be provided. Rough work can be done in the question paper itself/space provided at the end of the booklet.
10. This paper contains 24 pages including this page and pages for the rough work. Please check that your paper has all the pages.

**BIOLOGY**

1. Which one of the following is a hermaphrodite
  - A. Cockroach
  - B. Leech
  - C. Hydra
  - D. Sea urchin
  
2. The birds show one of the following
  - A. Viviparity
  - B. Ovoviviparity
  - C. Oviparity
  - D. Ovovivipary
  
3. Transfer of pollen grains from the anther to the stigma of a different plant
  - A. Geitonogamy
  - B. Autogamy
  - C. Anemophily
  - D. Xenogamy
  
4. The portion of the embryonal axis above the level of cotyledons is
  - A. Epicotyl
  - B. Hypocotyl
  - C. Scutellum
  - D. Coleorhiza
  
5. Klinefelter Syndrome is characterized by
  - A. The presence of an additional copy of 13-chromosome
  - B. The absence of one of the X-chromosome
  - C. The presence of an additional copy of 21-chromosome
  - D. The presence of an additional copy of X-chromosome XXY
  
6. Which one of the following is transcriptionally active
  - A. Euchromatin
  - B. Heterochromatin
  - C. Histone
  - D. Sugar Phosphate

7. The amino acids are coded by
- A. 57 codons
  - B. 61 codons
  - C. 33 codons
  - D. 31 codons
8. The wings of butterfly and of birds look alike performing similar functions. This is an example of
- A. Divergent Evolution
  - B. Convergent Evolution
  - C. Determinism and Adaptive Radiation
  - D. Anthropogenic Evolution
9. The enzyme responsible for initiating DNA replication in prokaryotes is
- A. DNA polymerase
  - B. DNA ligase
  - C. Beta- galactosidase
  - D. Restriction endonuclease
10. Cross breeding is
- A. Breeding between animals of same breed
  - B. Breeding between superior males of one breed with superior females of other breed
  - C. Breeding between animals of different breed
  - D. Breeding between inferior males of one breed with inferior females of other breed
11. The following is used in production of biogas
- A. Lactobacillus
  - B. Methanobacterium
  - C. Saccharomyces
  - D. Propionibacterium
12. The lichens are example of
- A. Parasitism
  - B. Commensalism
  - C. Amensalism
  - D. Mutualism

13. Following is a Moss

- A. Selaginella
- B. Sphagnum
- C. Chlamydomonas
- D. Cycas

14. Chordates are characterized by

- A. Presence of ventral heart
- B. Absence of Post-anal tail
- C. Absence of Gill slits
- D. Presence of ventral central nervous system

15. Coelom is absent in

- A. Echinodermata
- B. Annelida
- C. Platyhelminths
- D. Mollusca

16. Following is a modification of leaf in Peas

- A. Petiole
- B. Tendril
- C. Cymose
- D. Corolla

17. The placentation in tomato is

- A. Marginal
- B. Axile
- C. Basal
- D. Parietal

18. The bark of a tree comprises of

- A. All the tissues outside the cork cambium
- B. All the tissues outside the vascular cambium
- C. Only cork
- D. Just inside cork cambium

19. Annual rings are distinct in plants growing in

- A. Temperate regions
- B. Tropical regions
- C. Grasslands
- D. Arctic regions

20. Collagen is a
- A. lipid
  - B. carbohydrate
  - C. fibrous protein
  - D. globular protein
21. In cockroach, excretion is performed by
- A. Renette cells
  - B. Flame cells
  - C. Nephridia
  - D. Malpighian tubules
22. Identify the nonmembranous organelle from following
- A. Ribosome
  - B. Endoplasmic reticulum
  - C. Nucleus
  - D. Chloroplast
23. Smooth endoplasmic reticulum is the site of
- A. Protein synthesis
  - B. Carbohydrate synthesis
  - C. Aminoacid synthesis
  - D. Lipid synthesis
24. Microtubules are involved in
- A. Cell division
  - B. DNA recognition
  - C. Muscle contraction
  - D. Membrane contraction
25. Which stage is linked to DNA replication
- A. S-phase
  - B. G1 Phase
  - C. G2 Phase
  - D. Metaphase

**CHEMISTRY**

26. Which of the following shows anisotropy ?
- A. Naphthalene
  - B. Polyurathane
  - C. Cellophane
  - D. Teflon
27. The relation between oxygen and ozone is
- A. Isomers
  - B. Allotropes and oxygen is a weaker oxidizing agent than ozone
  - C. Allotropes with different oxidation state
  - D. Isomorphous
28. The bonding or attractive forces which lead to solidify  $\text{CCl}_4$
- A. Dispersion or London forces
  - B. Hydrogen bonding
  - C. Coulombic or electrostatic interactions
  - D. Dipole-dipole interactions
29. The correct statement about hexagonal and rhombohedral crystals is
- A. Both have all three sides of same length
  - B. Both have all angles same
  - C. Hexagonal has all sides of equal length, whereas rhombohedral has one side different in length than the other two.
  - D. Hexagonal has one side different in length than the other two, whereas rhombohedral has all sides of equal length.
30. The acid concentration found in a commercial soft drink is  $4.5 \times 10^{-5}$  M. The pH of the drink is
- A. 4.3
  - B. 5.3
  - C. 4.5
  - D. 5

31. Molarity of pure water is approximately
- A. 100
  - B. 18
  - C. 1
  - D. 56
32. The attribute not related to colligative properties is
- A. Lowering of vapour pressure
  - B. Depression in freezing point
  - C. Lowering of density
  - D. Elevation of boiling point
33. If at a constant temperature, two solutions A and B are separated by a semipermeable membrane and still there is no osmosis occurs between them than
- A. Both solutions are hypertonic
  - B. Both solutions are hypotonic
  - C. A is hypertonic solution and B is hypotonic solution
  - D. Both are isotonic solutions
34. The radioactive decay of  $^{235}\text{U}$  is a reaction of which order ?
- A. 0
  - B. 1
  - C. 2
  - D.  $1/2$
35. To a galvanic cell having electrodes of zinc and copper dipping in the solutions of their respective salts having concentration of  $1 \text{ mol dm}^{-3}$  each and has an electrical potential equal to 1.1 V electrolytic cell, if an external opposing potential of 1.1 V is applied then
- A. No reaction occurs
  - B. Zn dissolves at Zn-electrode and Cu deposits at Cu-electrode
  - C. Zn deposits at Zn-electrode and Cu dissolves at Cu-electrode
  - D. Zn deposits at Zn-electrode and Cu deposits at Cu-electrode
36. For a general reaction  $a\text{A} + b\text{B} \rightarrow c\text{C} + d\text{D}$ , the rate of the reaction
- A.  $a-b$
  - B.  $a+b$
  - C. Can only be determined experimentally

- D. c+d
37. The incorrect statement regarding colloidal particles is
- A. Colloidal particles display Tindall effect.
  - B. Colloidal particles display a highly ordered movement when viewed under a powerful ultramicroscope.
  - C. The colour of colloidal solution depends on the wavelength of light scattered by the dispersed particles.
  - D. Colloidal particles always carry an electric charge.
38. The incorrect statement about cryolite is
- A. Its formula is  $\text{Na}_3\text{AlF}_6$ .
  - B. It is used in the metallurgy of aluminium from bauxite.
  - C. Molten cryolite reduces the melting point of  $\text{Al}_2\text{O}_3$  upon mixing.
  - D. Molten  $\text{Al}_2\text{O}_3$  reduces the melting point of cryolite upon mixing.
39. Among the following molecules, the one possessing linear structure is
- A.  $\text{NO}_2$
  - B.  $\text{N}_2\text{O}$
  - C.  $\text{H}_2\text{O}$
  - D.  $\text{H}_2\text{O}_2$
40. The maximum oxidation state that can be displayed by 3d-transition elements is
- A. +5
  - B. +6
  - C. +7
  - D. +8
41. Both  $\text{Cr}^{2+}$  and  $\text{Mn}^{3+}$  have  $d^4$  configuration. Which of the following statement(s) is/are true?
- A. Both are oxidizing agents
  - B. Both are reducing agents
  - C.  $\text{Cr}^{2+}$  is oxidizing and  $\text{Mn}^{3+}$  reducing agents
  - D.  $\text{Cr}^{2+}$  is reducing and  $\text{Mn}^{3+}$  oxidizing agents



42. In the electromagnetic spectrum, the one with highest energy among the following is

- A. Visible light
- B. Ultraviolet light
- C. Gamma-rays
- D. Radiowave

43. In qualitative analysis, Nessler's reagent is used for the confirmation of which ion ?

- A.  $Mg^{2+}$
- B.  $Na^+$
- C.  $K^+$
- D.  $NH_4^+$

44.  $CaC_2$  upon reaction with water produces  $Ca(OH)_2$  and

- A. Methane
- B. Ethane
- C. Ethylene
- D. Acetylene

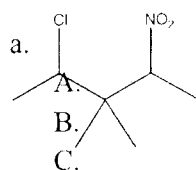
45. In the Friedel-Crafts acylation reaction, the electrophile is

- A.  $C_6H_5^+$
- B.  $C_6H_5CH_2^+$
- C.  $CH_3CO^+$
- D.  $AlCl_4^-$

46. Benzenediazonium salt can be directly prepared from

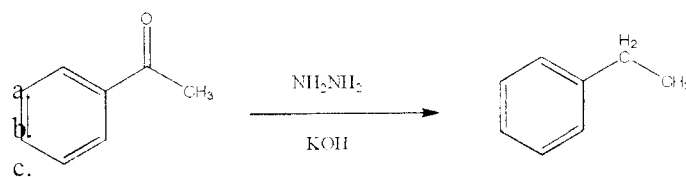
- A. Aniline
- B. Phenol
- C. Chlorobenzene
- D. Nitrobenzene

47. The IUPAC name of the following compound is



- A. 2-Nitro-3,3-dimethyl-4-chloropentane  
 B. 2-Chloro-3,3-dimethyl-4-nitropentane  
 C. 2-Chloro-3,3'-dimethyl-4-nitropentane  
 D. 2-Nitro-3,3'-dimethyl-4-chloropentane

48. The reaction



is known as

- A. Catalytic reduction  
 B. Clemmensen reduction  
 C. Wolff-Kishner reduction  
 D. Rosenmund reduction

49. In  $\text{PCl}_5$ , the hybridization of phosphorous is

- A.  $\text{sp}^3\text{d}$   
 B.  $\text{dsp}^2$   
 C.  $\text{sp}^3$   
 D.  $\text{sp}^3\text{d}^2$

50. In presence of catalytic acid or base, bakelite is produced during the reaction of phenol with

- A. Acetone  
 B. Formaldehyde  
 C. Acetaldehyde  
 D. Benzaldehyde

11-1

**Mathematics**

51. The points (1, 2), (1, 5) and (2, 5) are equidistant from
- (4/3, 4)
  - (4, 12)
  - (3,  $\pi$ )
  - (3/2, 7/2)
52. The perpendicular line from origin to a plane meets the plane at (3, 4, 2). The equation of the plane is
- $x + y + z = 9$
  - $3x + 4y + 2z = 29$
  - $2x + y + z = 0$
  - $x + y + z = 5$
53. If a circle passes through (1, -2) and has  $x - y = 2$  and  $2x + 3y = 14$  as diameters, the radius of the circle is
- 2
  - 3
  - 4
  - 5
54.  $\lim_{x \rightarrow 0} (\tan(x) - \sin(x))/x^3$  is
- 2
  - 2
  - 1/2
  - 1/2
55. Let  $y = 10e^x + 5e^{-x} - 2$ . Then  $y'''$  is
- 0
  - $y$
  - $y'$
  - $y''$
56. Let  $y = \sqrt{x + \sqrt{x + \sqrt{x + \dots}}}$ . Then  $(2y - 1)dy/dx$  is
- 0
  - 1
  - 1
  - None of the above

N-1

57.  $\sum_{n=0}^{\infty} (2i/3)^n$  is

- A.  $(9 + 6i)/5$
- B.  $(9 - 6i)/5$
- C.  $(9 + 6i)/13$
- D.  $(9 - 6i)/13$

58. (Modulus, principal argument) of  $(1 + i)$  is

- A.  $(\sqrt{2}, \pi/3)$
- B.  $(\sqrt{2}, \pi/4)$
- C.  $(1/\sqrt{2}, \pi/3)$
- D.  $(1/\sqrt{2}, \pi/4)$

59. Coefficient of  $x^2y^3z^4$  in  $(xy + yz + zx)^6$  is

- A. 40
- B. 50
- C. 60
- D. None of the above

60. The coefficient of seventh term in the expansion of  $(1 + x)^{11}$  is

- A. 11
- B.  ${}^{11}C_7$
- C.  ${}^{11}C_8$
- D.  ${}^{11}C_6$

61. Let  $f(a) = \log((1 + a)/(1 - a))$  for every  $a$  with  $0 < a < 1$ .  $f(2a/(1 + a^2))$  is

- A.  $f(a)$
- B.  $2f(a)$
- C.  $f(a)/2$
- D. None of the above.

62. Which of the following is divisible by 9 for all  $n \in \mathbb{N}$ ?

- A.  $10^n + 1$
- B.  $3^n + 3n - 3$
- C.  $4^n - 3n - 1$
- D.  $10^n + 1$

63. For every  $n \in \mathbb{N}$ ,  $(n^3 - 3n^2 + 2n)$  is always divisible by

- A. 4
- B. 6
- C. 8
- D. 12

64. Let  $M_2(\mathbb{R})$  be the set of all  $(2 \times 2)$  matrices with real numbers.  $\text{Det}: M_2(\mathbb{R}) \rightarrow \mathbb{R}$ , defined as

$\text{Det}(A)$  = determinant of  $A$  is

- A. one-one
- B. onto
- C. bijective
- D. None of the above

65. Let  $2A + B = \begin{bmatrix} 4 & 3 & 5 \\ 1 & 2 & 0 \\ 0 & 1 & -1 \end{bmatrix}$  and  $A + 3B = \begin{bmatrix} 2 & 5 & 7 \\ 3 & 1 & 0 \\ 0 & 9 & 11 \end{bmatrix}$ . Then trace of  $(B - 3A)$  is

- A. 1
- B. 2
- C. 4
- D. 0

66. Let  $a, b$  and  $c$  be unit vectors, no two of them collinear. Suppose  $a \times (b \times c) = b$ . Then angle between  $a$  and  $b$  is

- A.  $\pi/2$
- B.  $\pi/4$
- C.  $\pi/6$
- D.  $\pi/3$

67. Let  $E_1, E_2$  and  $E_3$  be three mutually exclusive events with  $p(E_i) = p_i$  for all  $i = 1, 2, 3$ . Suppose  $p_1 = (1 + p)/6$ ,  $p_2 = (2 + p)/7$  and  $p_3 = (3 + p)/8$ . Then  $p$  can be

- A. -1
- B. 1
- C. -3
- D. None of the above

68.  $A$  and  $B$  are two sets with  $|A| = 5$  and  $|B| = 6$ . The no. of one-one functions from  $A$  to  $B$  is

- A. 25
- B. 120
- C. 360
- D. 720

N-1

69. The three vertices of a triangle are  $(0, 0)$ ,  $(53a, 43)$  and  $(13, 15b)$ , where  $a$  and  $b$  are roots of the equation  $5x^2 + 3x + 20 = 0$ . The area of the triangle is
- 2521
  - 2621
  - 2721
  - None of the above
70. The point  $(2, -5)$  goes through the transformations below in the following order: First, it gets reflected with respect to  $X$  axis, then it gets translated in the positive direction of  $Y$  axis by 4 units and then is reflected with respect to the line  $x = y$ . The final position of the point is
- $(9, 2)$
  - $(2, 9)$
  - $(5, 6)$
  - $(-9, 2)$
71. A function  $f$  is defined on  $[0, 3]$ . The function  $f(16x^2 - 1)$  has domain
- $[0, 3]$
  - $[0, 4]$
  - $[0, 1]$
  - None of the above
72. Let  $S$  be the set of all  $(2 \times 2)$  matrices with 0 and 1 as entries. The probability of a matrix in  $S$  being nonsingular is
- $3/16$
  - $1/4$
  - $3/8$
  - None of the above
73.  $f$  and  $g$  are two functions defined on  $\mathbb{R}$ . Suppose  $\lim_{x \rightarrow 0} [f(x)g(x)]$  exists. Then
- $\lim_{x \rightarrow 0} f(x)$  exists
  - $\lim_{x \rightarrow 0} g(x)$  exists
  - Both  $\lim_{x \rightarrow 0} f(x)$  and  $\lim_{x \rightarrow 0} g(x)$  exist
  - None of the above
74. For  $a, b, c \in \mathbb{R}$ , the points  $(a, b + c)$ ,  $(b, c + a)$  and  $(c, a + b)$  are
- vertices of an equilateral triangle
  - vertices of a right angled triangle
  - collinear
  - None of the above

75. Suppose  $\begin{bmatrix} 1 & -\tan(\theta) \\ \tan(\theta) & 1 \end{bmatrix} \times \begin{bmatrix} 1 & \tan(\theta) \\ -\tan(\theta) & 1 \end{bmatrix}^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ . Then

- A.  $a = b = 1$
- B.  $a = \cos(2\theta), b = 2\sin(\theta)$
- C.  $a = \sin(2\theta), b = 2\cos(\theta)$
- D. None of the above.

NH

## PHYSICS

76. If two vectors  $\vec{a}$  and  $\vec{b}$  are oriented to each other such that  $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$  what is the angle between them.
- $0^\circ$
  - $45^\circ$
  - $90^\circ$
  - $180^\circ$
77. Two discs of equal radius  $r$  and equal volumes are made with materials of different densities  $\rho_1$  and  $\rho_2$ , the moment of inertias  $I_1$  and  $I_2$ , about the axis passing through the center and perpendicular to the plane of the disk, are related as
- $I_1 = I_2$
  - $I_1 = \rho_1 \rho_2 I_2$
  - $I_1 = I_2 \rho_1 / \rho_2$
  - $I_1 = I_2 \rho_2 / \rho_1$
78. A meteorite experiences a drag force as it enters the atmosphere given by  $D = \kappa v^2/2$ , where  $v$  is the instantaneous velocity and  $\kappa$  is a constant which depends on its shape. The terminal velocity  $v_f$  of the meteorite is given by
- $\frac{2\pi\eta}{\kappa}$
  - $\left(\frac{2\pi\eta}{\kappa}\right)^{1/2}$
  - $\left(\frac{2\pi\eta}{\kappa}\right)^{3/2}$
  - $\left(\frac{2\pi\eta}{\kappa}\right)^{1/2}$
79. A particle moving along the x-axis such that its position (from the origin)  $x$  meters at an instant of time  $t$  sec. is given by  $x(t) = 7.9 + 17t - t^2$ . The most appropriate statement about the motion of this particle is
- Uniform
  - Uniformly accelerating
  - Deaccelerating
  - Uniformly deaccelerating
80. A body of mass 5 kg is moving along positive x-axis under the action of uniform force of 25 N acting along the positive direction. Its velocity at a distance 20 m from the origin is 10 m/s. Its velocity at point 50 m from the origin and time taken to reach this point are
- 20 m/s, 2s
  - 20 m/s, 2s
  - 10 m/s, 2s
  - 10 m/s, 2s

M-1



81. A stone is thrown with an initial velocity 5 m/s such that it covers maximum possible horizontal distance  $R_M$  meters on the surface of the moon. The same stone is thrown with same initial velocity by a person standing on the earth, making an angle of  $15^\circ$  with the horizontal surface. Given that  $g_E = 9.8 \text{ m/s}^2$  and  $g_M = 1.6 \text{ m/s}^2$ , the horizontal distance it covers on earth surface is
- $9.8 R_M$  meters
  - $9.8/R_M$  meters
  - $R_M/9.8$  meters
  - $R_M/4.9$  meters
82. A body of mass  $m$  kg is constrained to move along a circle of radius  $r$  m. At a given instant, its speed is  $u$  m/s and the speed is increasing at the rate of  $a$  m/s<sup>2</sup>. The angle between particle's velocity and acceleration is
- $0^\circ$
  - $30^\circ$
  - $45^\circ$
  - $90^\circ$
83. The potential on the surface of a solid conducting sphere of radius  $r = 20$  cm is 100 V and the potential at  $r = 10$  cm is
- 100 V
  - 50 V
  - 25 V
  - zero
84. A particle of charge  $q_1$  is placed at  $x = a$  and another of charge  $q_2$  is placed at  $x = -2a$ . For the net force on a third charged particle at placed at the origin to be zero,  $q_2$  must equal to
- $2 q_1$
  - $4 q_1$
  - $-2 q_1$
  - $-4 q_1$
85. Charge  $Q$  is distributed uniformly throughout an insulating solid sphere of radius  $R$ . The magnitude of the electric field at a point  $2R/3$  from the center is
- $Q/6\pi\epsilon_0 R^2$
  - $Q/8\pi\epsilon_0 R^2$
  - $Q/72\pi\epsilon_0 R^2$
  - $11Q/18\pi\epsilon_0 R^2$

41

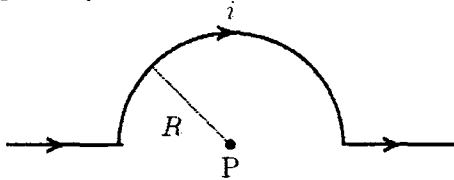
86. A given semiconductor  $Si$  is to be doped with the following element to make it n-type semiconductor

- A. Al
- B. Ge
- C. P
- D. S

87. An electron is launched with velocity  $v$  in a uniform magnetic field  $B$ . The angle  $\theta$  between  $v$  and  $B$  is in the range of  $0^\circ$  and  $90^\circ$ . As a result, the electron follows a helical path, its velocity vector  $v$  returning to its initial value in a time interval of

- A.  $(2\pi m \tan\theta)/eB$
- B.  $(2\pi m \cot\theta)/eB$
- C.  $(2\pi m \sin\theta)/eB$
- D.  $(2\pi m \cos\theta)/eB$

88. The magnitude of the magnetic field at point P, at the center of the semicircle shown, is given by



- A.  $2\mu_0 i/R$
- B.  $\mu_0 i/4R$
- C.  $\mu_0 i/4\pi R$
- D.  $\mu_0 i/2R$

89. Air is pumped into a soap bubble of radius  $r$  to triple its radius. If the surface tension of the soap solution is  $S$ , then the work done in the process is

- A.  $64\pi r^2 S$
- B.  $32\pi r^2 S$
- C.  $16\pi r^2 S$
- D.  $8\pi r^2 S$

90. The change in volume of an indiarubber cord when stretched within the elastic limit, the change in volume is almost negligible compared with the change in shape, then the Poisson's ratio is

- (A) 0
- (B) 0.25
- (C) 0.5
- (D) 1

M-1

91. The units of Planck's constant ' $h$ ' are same as those of

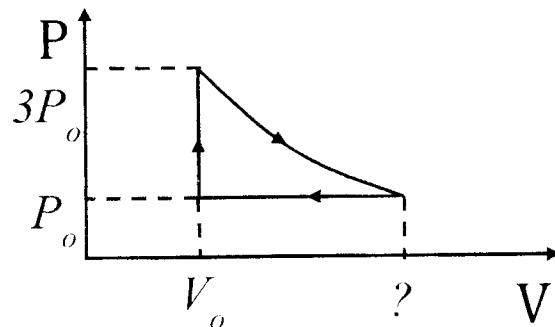
- A. energy
- B. Power
- C. momentum
- D. angular momentum

92. Possible values of the principal quantum number ' $n$ ' for an electron in atom are only

- A. 0 and 1
- B. 0, 1, 2, 3, ...,  $\infty$
- C. 1, 2, 3, ...,  $\infty$
- D. 0, 1, 2, ...,  $(l - 1)$

93. An ideal gas system from an initial state of pressure  $P_1$ , volume  $V_1$  and temperature  $T_1$  is taken through an isochoric process till its pressure become three times the original pressure and subsequently, expanded isothermally till the pressure is  $P_1$  again. The volume at the end of the isothermal process is

- A.  $\frac{1}{2}V_1$
- B.  $V_1$
- C.  $2V_1$
- D.  $3V_1$



94. An ice piece of mass 100 g at temperature  $0^\circ\text{C}$  is added to 200 g of water at  $25^\circ\text{C}$ . How much ice will remain in the water, immediately after the temperature of the water reaches  $0^\circ\text{C}$ ? The specific heat capacity of water is  $4200\text{ J kg}^{-1}\text{K}^{-1}$  and specific latent heat of fusion of ice is assumed to be  $2.1 \times 10^5\text{ J kg}^{-1}$ .

- A. 100 g
- B. 50 g
- C. 25 g
- D. 0 g

N-1

95. A solid at temperature  $T_1$  is kept in an evacuated chamber at temperature  $T_2 > T_1$ . The rate of increase of temperature of the body is proportional to
- A.  $T_2 - T_1$
  - B.  $T_2^2 - T_1^2$
  - C.  $T_2^3 - T_1^3$
  - D.  $T_2^4 - T_1^4$
96. A convex shaped contact lens is made of plastic whose refractive index is 1.50. The lens has an outer radius of curvature of 1.50 cm and inner radius curvature of 2.25 cm. The focal length of the lens is
- A. 1.80 cm
  - B. 4.50 cm
  - C. 9.00 cm
  - D. 9.50 cm
97. An organ pipe with both ends open is 1.5 m long. Assuming that the speed of sound is 340 m/s, the frequency of the third harmonic of this pipe is
- A. 170 Hz
  - B. 340 Hz
  - C. 680 Hz
  - D. 900 Hz
98. While standing at a cross walk, you hear a sound with frequency of 560 Hz from an approaching police car. After the police car passes and is moving away from you, you hear the sound with a frequency of 480 Hz. If the velocity of sound is  $V$  m/s, then the speed of the police car is
- A.  $2V/13$  m/s
  - B.  $V/13$  m/s
  - C.  $V/26$  m/s
  - D.  $V/39$  m/s
99. A detector placed at 5 m from a candle in a large, otherwise dark room receives a power of about  $2 \times 10^{-7}$  W. The power of light received by the detector when placed at a distance of 10 m from candle is
- A.  $2.0 \times 10^{-9}$  W
  - B.  $2.0 \times 10^{-8}$  W
  - C.  $5.0 \times 10^{-8}$  W
  - D.  $8.0 \times 10^{-8}$  W

100. Unpolarized light emitting from a laser source has energy of 12 watts. This laser beam is passed through the pair of polarizer & analyzer, which are kept at a relative angle of  $45^\circ$ . The output energy of the light after it emerges from the analyzer is

- A. 3 watts
- B. 4 watts
- C. 6 watts
- D. 9 watts

M-1