ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

M.Sc. (PHYSICS)

COURSE CODE : 374

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 374

Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. A particle of mass m moving with velocity v strikes a stationary particle of mass $2m$ and sticks to it. The speed of the system will be

(A) $3v$ (B) $2v$

(C) $v/3$ (D) $v/2$

2. A body completes one round of a circle of radius R in 20 seconds. The ratio of displacement to distance after 10 seconds is

(A) 7:11 (B) $2R:R$

(C) 11:7 (D) $R:2R$

3. Forces of equal magnitude act on a point. If the angle between the vectors is θ the magnitude of the resultant force is

(A) $f\sqrt{2(1-\sin\theta)}$ (B) $f\sqrt{2(1+\sin\theta)}$

(C) $2f\cos\frac{\theta}{2}$ (D) $2f\sin\frac{\theta}{2}$

4. What is the degeneracy of n^{th} excited state of two dimensional isotropic harmonic oscillator?

(A) $2n$ (B) n

(C) n^2 (D) $n+1$

5. The equation of wave travelling in a string is $y = 3\cos[\pi(100t - x)]$cm. Its wave length is given by

(A) 3 cm (B) 2 cm

(C) 5 cm (D) π cm

6. A travelling wave in a stretched string is $y = A\sin(kx - \omega t)$. The maximum velocity is

(A) ω/k (B) ωA

(C) $\frac{d\omega}{dk}$ (D) x/t

7. Young's modulus of the material of wire length L and radius r is YN/m^2. If the length is reduced to L/2 and radius to r/2, then the Young's modulus will be

(A) 2Y (B) Y

(C) Y/4 (D) Y/2

8. If three forces $\vec{i}+3\vec{j}+m\vec{k}, n\vec{i}+4\vec{j}-3\vec{k}$ and $-2\vec{i}-7\vec{j}+4\vec{k}$ keep a body in equilibrium, the value of m and n are respectively

(A) –1, 1 (B) 2, –3

(C) –3, 2 (D) 1, 1

9. The unit and dimension of Rydberg's constant is

(A) Joule and $\left[M^1L^2T^{-2}\right]$

(B) Meter^{-1} and $\left[M^{-1}\right]$

(C) Meter and $\left[M^1\right]$

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

10. A splash sound is heard 4.23 sec after a stone is dropped into a well of depth 78.4 meter. The velocity of sound as per this data is found to be

(A) 3×10^8m/s (B) 345 m/s

(C) 354 m/s (D) 323 m/s

11. If a shell of mass M moving with the velocity V breaks into two fragments. One of the mass comes to rest. Then the velocity of second fragment is

(A) $\frac{MV}{M-m}$ (B) $\frac{MV}{m+M}$

(C) $\frac{m+M}{MV}$ (D) $\frac{m-M}{MV}$

12. The momentum of a body in two perpendicular directions at any time t are given by $P_1 = 2t^2 + 6, P_2 = \frac{3}{2}t^2 + 3$. What is the force acting on the body at t = 2 seconds which causes this momentum?

(A) 5 N (B) 10 N

(C) 2 N (D) 0 N

13. In the case of projectile if kinetic energy and potential energy are equal at the highest point, then the angle of projection is

(A) 60° (B) 30°

(C) 45° (D) 90°

14. In a tug of war game a 2 kg mass is hanged from the middle of the rope. The force to be exerted on each side to make the rope horizontal again is

(A) Infinity (B) Zero

(C) 20N (D) 2N

15. If the kinetic energy of a particle increases by 300%, by what percentage its momentum has changed?

(A) 125% (B) 50%

(C) 100% (D) 300%

16. Three particles of masses 1kg, 2kg, and 3kg are subjected to forces $3\vec{i}-2\vec{j}+3\vec{k}, -\vec{i}+\vec{j}-\vec{k}$, and $\vec{i}+\vec{j}+\vec{k}$ Newton. What is the magnitude of the acceleration?

(A) $\sqrt{11}/6\,m/s^2$ (B) $\sqrt{22}/6\,m/s^2$

(C) $11/6\,m/s^2$ (D) $22/6\,m/s^2$

17. The maximum angular velocity of a car travelling along the curved path of radius 10 meter if the coefficient of static friction is 0.5

(A) 0.7 rad/s (B) 10 rad/s

(C) 7 rad/s (D) 0.1 rad/s

18. Which of the following is not a third order aberration?

(A) Astigmatism (B) Coma

(C) Distortion of field (D) Chromatic aberration

19. A flywheel rolls down on an inclined plane. At any instance of time, the ratio of rotational kinetic energy to total kinetic energy is

(A) 3:1 (B) 4:3

(C) 3:4 (D) 1:3

20. Linearly polarised light can be converted to circularly polarised light with the introduction of a

(A) Half wave plate (B) Attenuator

(C) Quarter wave plate (D) Polariser

21. In Michelson interferometer, as you decrease the separation between the two mirrors

(A) Fringes appears expanding

(B) Fringes appear collapsing

(C) No change in fringe pattern

(D) Sometimes it collapses and sometimes it expands

22. A uniform circular ring is rolling down an inclined plane on inclination 30° without slipping. Its linear acceleration along the inclined plane will be

(A) g/2 (B) g/3

(C) g/4 (D) 2g/3

23. Fraunhoffer diffraction can be observed for

(A) Source and screen are at finite distance

(B) Source and screen are at infinity

(C) Source is at finite and screen at infinity

(D) Source is at infinity and screen at finite distance

24. The potential energy between two atoms in a molecule is given by $U(x)=\frac{a}{x^{12}}-\frac{b}{x^{6}}$ where a and b are positive constants and x is the distance between two atoms in a molecule. The molecule will be in stable equilibrium if

(A) $x=0$ (B) $x=\left(\frac{a}{2b}\right)^{1/6}$

(C) $x=\left(\frac{2a}{b}\right)^{1/6}$ (D) $x=\left(\frac{11a}{5b}\right)^{1/12}$

25. Sommerfeld explained the hydrogen fine structure by applying the

(A) Heisenberg's principle

(B) Zeeman's effect

(C) Special theory of relativity

(D) Compton Effect

26. An atom containing one single valence electron, the external magnetic field is greater than the internal fields due to the spin and orbital motion of the electron We observe

(A) Zeeman effect (B) Paschen-Back effect

(C) Stark effect (D) Maxwell principle

27. A piece of wood is taken deep inside a long column of water and released. It will move up with a

(A) Constant upward acceleration
(B) Constant upward deceleration
(C) Uniform velocity
(D) Decreasing upward acceleration

28. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be

(A) 6
(B) 1
(C) 3
(D) 2

29. A black body at a high temperature T radiates energy at the rate of E W/m^2. When the temperature falls to T/2, the radiated energy (in W/m^2) will be

(A) E/2
(B) E/4
(C) 2E
(D) E/16

30. The function $f(x)=\sqrt{x}$

(A) Uniformly continuous on [0, 1] but not on [0, ∞)
(B) Uniformly continuous on [0, ∞).
(C) Uniformly continuous on [0, 1].
(D) Uniformly continuous on [0, 1)

31. What kind of doping is needed to make intrinsic Si to a n-type semiconductor?

(A) Dope with tetravalent atoms
(B) Dope with pentavalent atoms
(C) Dope with trivalent atoms
(D) None

32. The mass of an electron whose velocity is 0.99c will be

(A) 7 times greater than electron rest mass
(B) 5 times greater than electron rest mass
(C) 6 times greater than electron rest mass
(D) None of the above

33. Find the longest wavelength present in the Balmer series of Hydrogen corresponding to the H_α line.

(A) 600 nm
(B) 556 nm
(C) 656 nm
(D) 565 nm

34. The energy of a 700 nm photon is equal to

(A) 1.77 eV (B) 1.44 eV

(C) 2.0 eV (D) 2.77 eV

35. Electrons are accelerated in television tubes through potential difference of about 10 kV. Find the highest frequencies of electromagnetic waves emitted when these electrons strike the screen of the tube.

(A) 2.4×10^{10} Hz (B) 2.4×10^{18} Hz

(C) 2.4×10^{15} Hz (D) 2.4×10^{11} Hz

36. The distance between the adjacent atomic planes in Calcite ($CaCO_3$) is 0.3 nm. Find the smallest angle of Braggs scattering for 0.030 nm X-ray.

(A) 29° (B) 12.9°

(C) 3.9° (D) 1.9°

37. Find the de Broglie wavelength of a 46 gram ball with a velocity of 30 m/s.

(A) 4.8×10^{-34} cm (B) 4.8×10^{-31} m

(C) 4.8×10^{-34} m (D) 2.8×10^{-34} m

38. The radius of hydrogen atom is 5.3×10^{-11}m. Use the uncertainty principle to estimate the minimum energy an electron can have in this atom.

(A) 5.4 eV (B) 1.609×10^{-19} J

(C) 5.4×10^{-19} J (D) 1.904 eV

39. Green light has a wavelength of 550 nm. Through what potential difference must an electron be accelerated to have this wavelength?

(A) 5.0 mV (B) 5.0 nV

(C) 5.0 μV (D) None

40. Find the phase velocity of the de Broglie waves of an electron whose kinetic energy is 500 keV. [Here c is the velocity of light.]

(A) 1.16c (B) 2.16c

(C) 3.16c (D) 0.16c

41. An eigen function of the operator $\frac{\hat{d^2}}{dx^2}$ is given by $\psi = e^{2x}$. The corresponding eigen value will be

(A) 2 (B) 3

(C) 4 (D) 5

42. The probability that a particle in a box of length L can be found between $x = 0$ and $x = L/n$ is

(A) 2/n (B) 3/n

(C) Zero (D) 1/n

43. What are the possible orientations of J for the j = 1/2 state that corresponds to $l = 1$?

(A) $m_j = -1, 0, 1$ (B) $m_j = -\frac{1}{2}, \frac{1}{2}$

(C) $m_j = -1, -\frac{1}{2}, 0, \frac{1}{2}, 1$ (D) $m_j = -1, 1$

44. Is it possible for a ${}^2P_{5/2}$ states to exist?

(A) Possible (B) Sometimes possible

(C) Impossible (D) None

45. How many electrons can f-sub-shell occupy?

(A) 12 (B) 14

(C) 6 (D) 8

46. In NaCl crystal, the equilibrium distance between ions is 0.281 nm. Find the cohesive energy of the NaCl crystal. (α = 1.748 and n = 9)

(A) –7.96 eV (B) –7.06 eV

(C) 7.96 eV (D) –6.96 eV

47. When germanium is doped with aluminum, we get ———— material.

(A) p-type (B) n-type

(C) Intrinsic (D) It depends on temperature

48. Find the S, L, J values that corresponds to the following state ${}^3P_2$.

(A) 1,1,1 (B) 1,1,2

(C) 0,1,1 (D) 2,2,2

49. An electron is in a box of size 0.10 nm. The energy of the electron in that box will be

(A) $E_n = 36n^2$ eV (B) $E_n = 38n^2$ eV

(C) $E_n = 35n^2$ eV (D) $E_n = 34n^2$ eV

50. Find the transmission probability of electron with energy 1.0 eV which is incident on a barrier of 10.0 eV height and 0.5 nm width.

(A) $T = 1.1 \times 10^{-6}$ (B) $T = 1.1$ nm

(C) Zero (D) $T = 1.1 \times 10^{-7}$

51. A capacitor of capacitance C is discharging through a resistor of resistance R. Let the time constant $\tau = RC$. When will the energy stored in the capacitor be half its initial value?

(A) 0.35τ (B) 2τ

(C) $\frac{2}{3}\tau$ (D) $\tau/2$

52. A car battery with a 12 V emf and an internal resistance of 0.040 ohms is being charged with a current of 50 Amperes. At what rate is energy being dissipated as thermal energy in the battery?

(A) 100 J per hour

(B) 100 W per hour

(C) 100 J.sec

(D) 100W

53. Two stationary tuning forks (350 and 352 Hz) are struck simultaneously. The resulting sound is observed to

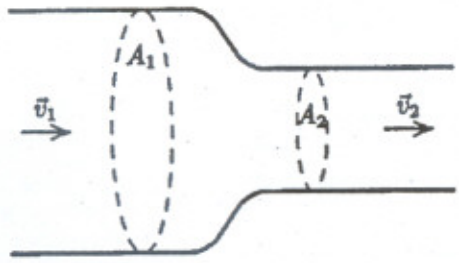
(A) beat with a frequency of 351 beats / sec

(B) have a frequency of 702 Hz

(C) be Doppler shifted by 2 Hz

(D) beat with a frequency of 2 beats/sec

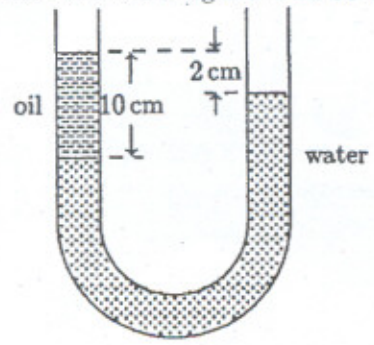
54. The flow of an incompressible liquid in a pipe of varying diameter is shown in the figure. The speed of the liquid is v_1 in region where the area of cross section is A_1. Then, the ratio of the speeds v_2 / v_1, is equal to



(A) $\sqrt{A_1 / A_2}$ (B) A_2 / A_1

(C) A_1 / A_2 (D) $A_1 v_1 / A_2 v_2$

55. The density of water is 1 g.cm^{-3}. The density of oil in the left column of the U-tube shown in the figure will be equal to



(A) 0.2 g.cm^{-3} (B) 1.3 g.cm^{-3}

(C) 0.8 g.cm^{-3} (D) 1.8 g.cm^{-3}

56. A circular coil of 160 turns has a radius of 1.90 cm. Calculate the current that results in a magnetic dipole moment of 2.30 Am^2.

(A) 10.7 mA (B) 2.7A

(C) 12.7A (D) 19.23 nA.

57. A solenoid has length of 1.23 m and inner diameter 3.55 cm and it carries a current of 5.57 A. It consists of five close packed layers, each with 850 turns along its length. What is the magnetic flux density at its center?

(A) 24.2×10^{-4}T (B) 242 μT

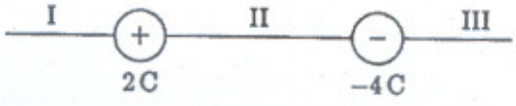
(C) 242 nT (D) 24.2 mT

58. A particle with positive charge q is a distance d from a long straight wire that carries a current i, the particle is travelling with speed v perpendicular to the wire. What is the magnitude of force on the particle if it is moving toward the wire?

(A) $\frac{\mu_o i}{2\pi}\left(\frac{qv}{d}\right)$ (B) $\frac{\mu_o i}{2\pi}\left(\frac{qv}{2d}\right)$

(C) $\frac{\mu_o i}{4\pi}\left(\frac{qv}{d}\right)$ (D) $\frac{\mu_o i}{4\pi}\left(\frac{qv}{d^2}\right)$

59. Two charged particles are arranged as shown in figure. In which region could a third particle, with charge +1 C, be placed so that the net electrostatic force on it is zero?



(A) Region I only (B) Region III only

(C) Between regions I and III only (D) Between regions I and II only

60. A coil has an inductance of 53 mH and a resistance of 0.35 ohm. If a potential difference of 12 V is applied across the coil, how much energy is stored in the magnetic field after the current has built up to its equilibrium value?

(A) 31 eV

(B) Cannot be calculated without knowing equilibrium current.

(C) 31J

(D) 3.1×10^3J

61. If E and B are the magnitudes of a electric and magnetic fields at any point, the density of stored electromagnetic energy at that point is

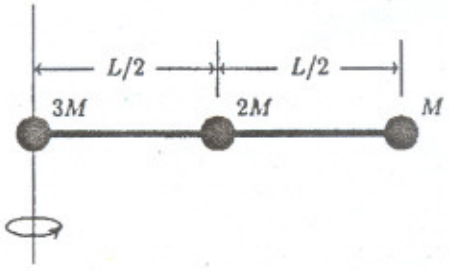
(A) $\frac{1}{2}\left(\in E^2 + \mu B^2\right)$

(B) $\frac{1}{2}\left(\in E + \frac{B}{\mu}\right)^2$

(C) $\in E^2 + \frac{B^2}{\mu}$

(D) $\frac{1}{2}\left(\in E^2 + \frac{B^2}{\mu}\right)$

62. Three identical balls, with masses of M, 2M and 3M, are fastened to a massless rod of length L as shown in the figure. The rotational inertia about the left end of the rod is equal to



(A) $\frac{3}{2}ML^2$

(B) $\frac{1}{2}ML^2$

(C) ML^2

(D) $\frac{3}{4}ML^2$

63. The expression $\oiint \vec{B} \cdot d\vec{S} = 0$ is

(A) Gauss law for electrostatics.

(B) Ampere's law

(C) Biot-Savart law

(D) Representing non-existence of magnetic monopole

73. A magnifying glass has a focal length f. If D is the least distance of distinct vision, then, the maximum magnification M_{max} achievable with this glass is given by

(A) $M_{max} = 1 + \frac{D}{f}$ (B) $M_{max} = \frac{D}{f}$

(C) $\frac{1}{M_{max}} = \frac{1}{f} + \frac{1}{D}$ (D) $\frac{1}{f} = \frac{1}{M_{max}} + \frac{1}{D}$

74. According to kinetic theory of gases, the average speed V_{avg} of gas molecules of molecular mass M at temperature T is equal to

(A) $v_{avg} = \sqrt{\frac{3RT}{m}}$ (B) $v_{avg} = \sqrt{\frac{2RT}{m}}$

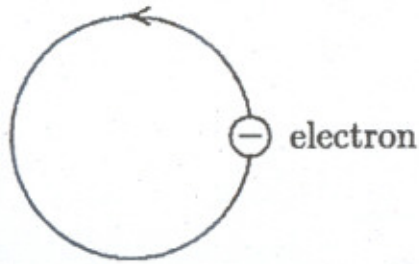
(C) $v_{avg} = \sqrt{\frac{8RT}{m}}$ (D) $v_{avg} = \sqrt{\frac{8RT}{\pi m}}$

75. A detector or an observer D is stationary and the sound source S with sound frequency f is moving with speed v_s. If V is the velocity of speed in air, then, the new frequency f', of the sound source as observed by the detector is given by (according to Doppler effect)

(A) $\frac{f}{f'} = \left(\frac{V}{V + v_s}\right)$ (B) $\frac{f'}{f} = \left(\frac{V}{V + v_s}\right)$

(C) $\frac{f'}{f} = \left(\frac{V}{V - v_s}\right)$ (D) $\frac{f'}{f} = \left(\frac{V - v_s}{V}\right)$

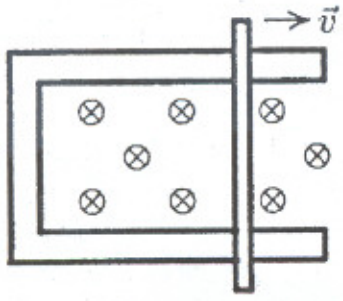
76. Electrons are going around a circle in a counter clockwise direction as shown. At the center of the circle they produce a magnetic field that is directed (in direction)



(A) Into the page (B) Nowhere

(C) In-plane with the page (D) Out of the page

77. A rod lies across frictionless rails in a constant uniform magnetic field B as shown. The rod moves to the right with speed v. In order for the emf around the circuit to be zero, the magnitude of the magnetic field should



(A) Increase linearly with time
(B) Decrease linearly with time
(C) Decrease quadratically with time
(D) Not change with time

78. One gram of distilled water at 4°C

(A) will increase slightly in weight when heated to 6°C
(B) will decrease slightly in weight when heated to 6°C
(C) will decrease slightly in volume when heated to 6°C
(D) will increase slightly in volume when heated to 6°C

79. During a slow adiabatic expansion of a gas

(A) the pressure remains constant
(B) no energy enters or leaves as heat
(C) energy is added as heat
(D) work is done on the gas

80. Three complex numbers $z_1 = a + i$, $z_2 = 1 + ib$ and $z_3 = 0$ form an equilateral triangle where a and b are real numbers between 0 and 1. Then,

(A) $a = 2 - \sqrt{3}, b = \sqrt{3} - 1$
(B) $a = b = 2 + \sqrt{3}$
(C) $a = \sqrt{3} - 1, b = 2 - \sqrt{3}$
(D) $a = b = 2 - \sqrt{3}$

81. The number of solutions of the equation $\sqrt{4 - x} + \sqrt{x + 9} = 5$ is

(A) 0
(B) 1
(C) 3
(D) 2

82. Let $a^2+b^2+c^2=-2$ and $f(x)=\begin{vmatrix}1+(a^2x) & (1+b^2)x & (1+c^2)x\\ (1+a^2)x & 1+(b^2x) & (1+c^2)x\\ (1+a^2)x & (1+b^2)x & 1+(c^2x)\end{vmatrix}$. Then, f(x) is a polynomial of degree

(A) 1 (B) 0

(C) 3 (D) 2

83. Let $P=\begin{vmatrix}\sqrt{3}/2 & 1/2\\ -1/2 & \sqrt{3}/2\end{vmatrix}$, $A=\begin{bmatrix}1 & 1\\ 0 & 1\end{bmatrix}$ and $Q=PAP'$, then the value of $P'Q^{100}P$ is equal to

(A) $\begin{bmatrix}1 & 100\\ 0 & 1\end{bmatrix}$ (B) $\begin{bmatrix}1 & -100\\ 0 & 1\end{bmatrix}$

(C) $\begin{bmatrix}100 & 1\\ 0 & 100\end{bmatrix}$ (D) $\begin{bmatrix}1 & 10\\ 0 & 1\end{bmatrix}$

84. If A and B are coefficients of x^n in the expansion of $(1+x)^{2n}$ and $(1+x)^{2n-1}$, then

(A) A = 2B (B) A = B

(C) 2A = B (D) $\frac{A}{B}=(2n)!$

85. Evaluate the sum of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\ldots n$ terms

(A) $\frac{n}{2^n}$ (B) $\frac{n+1}{2^{n+1}}$

(C) $n+1-\frac{1}{2^n}$ (D) $n-1+\frac{1}{2^n}$

86. Evaluate the limit : $\lim_{n\to\infty}\left(6^n+5^n\right)^{1/n}$

(A) 6 (B) 5

(C) Infinity (D) 5/6

87. Let $f(x+y)=f(x)f(y)$ for all x and y. If $f(5)=2$ and $f'(0)=3$, then, the value of $f'(5)$ is equal to

(A) 5 (B) 8

(C) 6 (D) 0

88. Let $t = e^x$ and $y = t^2 - 1$. Then, the value of $\left.\frac{d^2y}{dx^2}\right|_{x=0}$ is equal to

(A) 0 (B) 4

(C) e^4 (D) log(4)

89. The minimum value of $f(x) = |3+x| + |2+x| + |5-x|$ where $x \in (-\infty, +\infty)$ is

(A) 7 (B) 10

(C) 0 (D) –3

90. Evaluate the integral : $I = \int \frac{dx}{\sin x + \cos x}$.

(A) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{\pi}{4} + \frac{x}{8}\right)\right| + C$ (B) $\sqrt{2} \log\left|\tan\left(\frac{\pi}{8} + \frac{x}{2}\right)\right| + C$

(C) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{\pi}{8} + \frac{x}{2}\right)\right| + C$ (D) $\frac{1}{\sqrt{2}} \log\left|\tan\left(\frac{\pi}{8} - \frac{x}{4}\right)\right| + C$

91. Evaluate the definite integral : $I = \int_{x/4}^{3\pi/4} \frac{dx}{1+\cos x}$

(A) 0 (B) $-\pi/2$

(C) 2 (D) $\pi/2$

92. If the vertex of a triangle is (1, 1) and the midpoints of two sides through this vertex are (–1, 2) and (3, 2) then, the centroid of the triangle is

(A) $\left(-1, \frac{7}{3}\right)$ (B) $\left(-\frac{1}{3}, \frac{7}{3}\right)$

(C) $\left(1, \frac{7}{3}\right)$ (D) $\left(\frac{1}{3}, \frac{7}{3}\right)$

93. A triangle is formed by the pair of straight lines $8x^2 - 6xy + y^2 = 0$ and the straight line $2x + 3y = c$. The area of the triangle so formed is equal to 7. Then, the value of c is equal to

(A) $14\sqrt{2}$ (B) 14

(C) 28 (D) $28/\sqrt{2}$

94. In an ellipse, the distance between the focii is 6 and the minor axis is 8. Then, its eccentricity is

(A) $1/\sqrt{5}$ (B) 3/5

(C) 1/2 (D) 4/5

95. The binding energy per nucleon

(A) increases for some, but not all, fission events

(B) decreases for all fission events

(C) decreases for some, but not all, fission events

(D) increases for all fission events

96. Fission fragments usually decay by emitting

(A) electrons and neutrons (B) alpha particles

(C) positrons and neutrons (D) only neutrons

97. Which one of the following is NOT needed in a nuclear fission reactor?

(A) Accelerator (B) Moderator

(C) Nuclear fuel (D) Coolant

98. The purpose of a moderator in a nuclear reactor is to

(A) provide neutrons for the fission process

(B) absorb dangerous gamma radiation

(C) shield the reactor operator from dangerous radiation

(D) slow down fast neutrons to increase the probability of capture by uranium

99. Beta particles from various radioactive sources all have

(A) the same speed (B) the same mass

(C) the same charge (D) the same deflection

100. The relation between the disintegration constant λ and the half-life T of a radioactive substance is

(A) $\lambda = 2T$ (B) $\lambda = 1/T$

(C) $\lambda T = \log 2$ (D) $\lambda T = \log (1/2)$