

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

M.Sc. (ASTRO PHYSICS)

COURSE CODE : 313

Register Number :

*Signature of the Invigilator
(with date)*

COURSE CODE : 313

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. What is the dimensional formula of specific heat?

(A) $[M L^{-2} T^{-2}]$	(B) $[M^0 L^2 T^{-2} K^{-1}]$
(C) $[M^0 L T^{-2}]$	(D) $[M L T^{-2}]$

2. If L has the dimensions of length; V that of potential and ϵ_0 is the permittivity of free space then quantity $\epsilon_0 L V$ have the dimensions of:

(A) Current	(B) Resistance
(C) Charge	(D) Voltage

3. A tiger chases a horse 30 m ahead of it and gains 3 m in 5 s after the chase started. After 10 s, the distance between them is

(A) 18 m	(B) 14 m
(C) 24 m	(D) 6 m

4. The angle between $\hat{i} + \hat{j} + \hat{k}$ and $2\hat{i} + 2\hat{j} + 2\hat{k}$ is

(A) 90°	(B) 60°
(C) 30°	(D) 0°

5. A particle moves in a plane with uniform acceleration having direction different than that of instantaneous velocity. What is the nature of trajectory.

(A) straight line	(B) parabola
(C) circle	(D) ellipse

6. A particle of mass m is projected with a velocity V making an angle 45° with the horizontal. The magnitude of the angular momentum of the particle is at its maximum height h is

(A) zero	(B) $\frac{mv^3}{\sqrt{2g}}$
(C) $m^2 \sqrt{2gh^3}$	(D) $\frac{mv^3}{4\sqrt{2g}}$

7. Drums of oil are carried in a truck. If constant acceleration is applied on the truck, the surface of the oil in the drum will

(A) Remain unaffected	(B) Rise towards backward direction
(C) Rise towards forward direction	(D) Nothing is certain

8. When a carpet is beaten by a stick, the dust particles drop down according to
- (A) Newton's 1st law of motion (B) Newton's 2nd law of motion
(C) Newton's 3rd law of motion (D) None of these
9. Which one of the following forces is non-conservative?
- (A) Electrostatic force (B) Frictional force
(C) Elastic force (D) Viscous force
10. A uniform chain of length l and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge, the work done to pull the hanging part to the table is
- (A) Mgl (B) $Mgl/3$
(C) $Mgl/9$ (D) $Mgl/18$
11. An ideal gas molecule at room temperature possesses
- (A) Potential energy (B) Kinetic energy
(C) Electrical energy (D) No energy
12. A thin circular ring of mass M and radius R is rotating about its central axis with angular velocity ω . Four point objects each of mass m are attached gently to the opposite ends of two \perp diameters, the angular velocity of the ring is given by
- (A) $\frac{M}{M+m} \omega$ (B) $\frac{M}{M+4m} \omega$
(C) $\frac{M+4m}{M} \omega$ (D) $\frac{M-4m}{M+4m} \omega$
13. When ice at poles melts, duration of day
- (A) Increases
(B) Decreases
(C) Remains same
(D) May increase or decrease depending upon rate of melting
14. When a steady torque or couple acts on a body, the body
- (A) continues in a state of rest or of steady motion
(B) gets linear acceleration
(C) continues to rotate at steady rate
(D) gets an angular acceleration

15. What remains constant when earth revolves round the sun?
(A) Linear K.E. (B) Angular K.E.
(C) Linear momentum (D) Angular momentum
16. Which of the following interactions is the weakest?
(A) Gravitational (B) Electrostatic
(C) Nuclear (D) None of these
17. Intensity of gravitational field inside the hollow spherical shell is
(A) variable (B) zero
(C) minimum (D) maximum
18. To an astronaut in the spaceship, the sky appears pitch dark. This is due to
(A) absence of atmosphere in neighborhood
(B) light from sky is absorbed by medium surrounding him
(C) the fact that at height, the sky radiations are only infrared and ultraviolet
(D) the fact that human eye becomes blind from blue colour
19. Where the intensity of gravitational field of the earth is maximum
(A) centre of earth (B) equator
(C) poles (D) same everywhere
20. If a spoon is dropped by an astronaut in an artificial satellite
(A) The spoon will fly away due to centrifugal force
(B) The spoon will fall on earth due to gravitational attraction
(C) The spoon will move with same orbital velocity as that of the satellite
(D) None of these
21. Brownian motion has played a convincing role in establishing
(A) kinetic theory of gases
(B) mechanical equivalence of heat
(C) elastic nature of molecular collisions
(D) none of the above
22. When the temperature increases, the angle of contact of liquid will
(A) increase (B) decrease
(C) remain unchanged (D) first decrease and then increase .

23. A body floats in a liquid contained in a beaker. The whole system falls freely under gravity. The up thrust on the body due to the liquid is
- (A) zero
 (B) equal to the weight of the liquid displaced
 (C) equal to the weight of the body in air
 (D) equal to the weight of the immersed portion of the body.
24. An artificial satellite is orbiting the earth at an altitude 400 km. A bomb is released from the satellite. The bomb will
- (A) reach earth in 10 minute (B) reach earth in 30 minute
 (C) orbit the earth along with the satellite (D) None of these
25. A force of 200 n makes an angle of 30° with the spokes of the wheel. If the radius of rim is 25 cm find the torque.
- (A) 25 Nm (B) 32.1 Nm
 (C) 40 Nm (D) none of these
26. A mass of 1 kg is suspended from a spring and has a time period T on the surface of earth. The period at the centre of the earth
- (A) zero (B) T (C) 2T (D) infinite
27. A particle undergoes S.H.M having time period T. The time taken in $\frac{3}{8}$ th oscillation is
- (A) $\frac{3}{8}T$ (B) $\frac{5}{8}T$ (C) $\frac{5}{12}T$ (D) $\frac{7}{12}T$
28. The intensity of plane progressive wave of frequency 100 Hz is 10 watt/m^2 . Given that speed of sound is 330 m/s and density of a is 1.293 kg/m^3 . then maximum change in pressure in N/m^2 is
- (A) 3×10^{-4} (B) 3×10^{-5}
 (C) 3×10^{-3} (D) 3×10^{-2}
29. A stretched string fixed at both ends has n nodes then the length of the string in terms of wavelength is
- (A) $n \frac{\lambda}{2}$ (B) $(n+1) \frac{\lambda}{2}$
 (C) $(n-1) \frac{\lambda}{2}$ (D) $\left(n + \frac{1}{2}\right) \frac{\lambda}{2}$.

30. The wavelength of light coming from a star shifts towards the violet end of the spectrum. This shows that star is
- (A) receding from the earth
 - (B) approaching the earth
 - (C) neither approaching nor receding from the earth
 - (D) sometimes approaching and sometimes receding from the earth.
31. Ultrasonics are used for stirring liquid solutions in order to produce
- (A) soundless stirring
 - (B) perfectly homogeneous solution
 - (C) chemical reactions in them
 - (D) none of the above.
32. For production of beats the two sources must have
- (A) different frequencies and same amplitude
 - (B) different frequencies
 - (C) different frequencies same amplitude and same phase
 - (D) different frequencies and same phase.
33. Decibel is
- (A) a musical instrument
 - (B) a musical note
 - (C) a measure of sound level
 - (D) the wavelength of noise.
34. Compressed air coming out of punctured football becomes cooler because of
- (A) adiabatic
 - (B) joule Thomson effect
 - (C) isothermal expansion
 - (D) energy dissipation
35. Cooking food in pressure cooker saves time and fuel because
- (A) under increased pressure, water can be made to boil at a temperature higher than 100°C
 - (B) heat losses are reduced to a minimum
 - (C) condensation of steam is prevented
 - (D) under increased pressure, water can be made boil at a temperature much lower than the 100°C .
36. To keep correct time, watches are fitted with a balance wheel made of
- (A) Platinum
 - (B) Tungsten
 - (C) Invar
 - (D) Stainless steel.
37. The ideal gas equation $PV = RT$ is true for
- (A) Isothermal process only
 - (B) Adiabatic process only
 - (C) Both isothermal and adiabatic processes only
 - (D) All processes.

38. For a gas $\frac{R}{C_v} = 0.67$ this gas is made up of molecules which are
- (A) Polyatomic
 - (B) Monatomic
 - (C) Diatomic
 - (D) Mixture of diatomic and polyatomic molecules.
39. The internal energy of a perfect gas does not change during
- (A) adiabatic process
 - (B) isothermal process
 - (C) isobaric process
 - (D) isochoric process
40. The slope of adiabatic P – V diagram as compared to the slope of isothermal P – V diagram is
- (A) greater
 - (B) smaller
 - (C) same
 - (D) cannot be estimated
41. The gas is expanded adiabatically and its temperature falls to T₁. It is then expanded isothermally and temperature now is T₂. Then
- (A) T₁ > T₂
 - (B) T₁ = T₂
 - (C) T₁ < T₂
 - (D) T₁ is nearly equal to T₂
42. Which of the following is the best conductor of heat?
- (A) Water
 - (B) Alcohol
 - (C) Wood
 - (D) Mercury
43. A perfectly black body is one whose emissive power is
- (A) zero
 - (B) unity
 - (C) maximum
 - (D) minimum
44. The running of fan makes us comfortable during summer, because it
- (A) decreases the temperature of air
 - (B) increases the thermal conductivity of air
 - (C) increases the rate of evaporation of perspiration
 - (D) cuts off the thermal radiation reaching us.
45. With sound waves one cannot observe the phenomenon of
- (A) Refraction
 - (B) Diffraction
 - (C) Interference
 - (D) Polarization

46. Ultrasonic waves are produced by utilizing
- (A) Coulomb's law (B) Peltier effect
(C) Piezoelectric effect (D) Doppler's principle
47. The absolute temperature of a perfectly black body is doubled. The heat radiated from it will become how many times
- (A) 4 times (B) 8 times
(C) 16 times (D) 32 times
48. The coefficients of thermal conductivity of a metal depends on
- (A) Temperature difference between the two sides
(B) Thickness of the metal plate
(C) Area of the plate
(D) None of the above
49. Calculate the self-potential energy of a charge q distributed over the surface of a hollow sphere of radius R
- (A) $\frac{q^2}{8\epsilon_0 R}$ (B) $\frac{q^2}{4\epsilon_0 R}$
(C) $\frac{q^2}{4\pi\epsilon_0 R}$ (D) $\frac{q^2}{8\pi\epsilon_0 R}$
50. An ammeter has resistance R_0 and range I , what resistance should be connected in parallel to it to increase the range to nI
- (A) R_0/n (B) $R_0/(n-1)$
(C) $R_0/(n+1)$ (D) None of these
51. An electron is shot into a liquid placed in a uniform magnetic field, in a plane perpendicular to magnetic field, then
- (A) the trajectory of electron is circular
(B) trajectory is an inward winding spiral
(C) the kinetic energy of electron remain same
(D) its revolution frequency decreases
52. A straight wire of diameter 0.5 mm carrying a current of 1 ampere is replaced by another wire of 1 mm diameter carrying the same current. The strength of the magnetic field far away is
- (A) twice the earlier value (B) one half of the earlier value
(C) one quarter of the earlier value (D) same as the earlier value

53. The meniscus of a liquid contained in one of the limbs of narrow U-tube is placed between the pole-pieces of an electromagnetic with the meniscus in line with the field. On switching the field the liquid rises in the limb, this indicates that liquid is :
- (A) ferromagnetic (B) paramagnetic
(C) diamagnetic (D) nonmagnetic
54. Unit of pole strength is
- (A) Am (B) Am-1
(C) Am-2 (D) Am2
55. Agonic lines are
- (A) zero declination (B) equal declination
(C) zero dip (D) equal dip
56. A vibration magnetometer is placed at the south pole, then the time period will be
- (A) zero (B) infinity
(C) same as at equator (D) same as at any other place on earth
57. A compass needle when placed at a geomagnetic pole stays along
- (A) South-North direction only (B) East-West direction only
(C) Any direction (D) None of the above
58. A magnetic field is measured by
- (A) Avometer (B) Pyrometer
(C) Fluxmeter (D) Thermopile.
59. The material of a permanent magnet has
- (A) High retentivity and low coercivity
(B) Low retentivity and high coercivity
(C) High retentivity and high coercivity
(D) Low retentivity and low coercivity
60. Earth's magnetic field always has a horizontal component except at
- (A) equator (B) magnetic pole
(C) latitude of 60° (D) none of these
61. A tangent galvanometer is most sensitive when the deflection is around
- (A) 0° (B) 30°
(C) 45° (D) 90°

62. In a D.C motor, the current flowing through the armature is minimum when induced e.m.f. is
 (A) zero (B) maximum
 (C) one half of maximum (D) none of these
63. A current $I_0 = 1.9 \text{ A}$ flows in a long solenoid. The wire it is wound of, is in a super conducting state. Find the current I flowing in the solenoid, if the length of the solenoid is increased by $\eta = 5\%$.
 (A) 1 A (B) 2 A
 (C) 3 A (D) 4 A
64. Two alternating voltage generators produce emfs of the same amplitude E_0 but with a phase difference of $\pi/3$. The resultant e.m.f. is
 (A) $E_0 \sin(\omega t + \pi/3)$ (B) $E_0 \sin(\omega t + \pi/6)$
 (C) $\sqrt{3} E_0 \sin(\omega t + \pi/6)$ (D) $\sqrt{3} E_0 \sin(\omega t + \pi/2)$
65. A man stands on a vertical tower of height 20 m. Calculate the distance up to which he will be able to see on the surface of earth. Neglect height of man. Radius of earth is 6400 km.
 (A) 4 km (B) 8 km
 (C) 12 km (D) 16 km
66. The area of moon's image produced by a convex lens is proportional to focal length as
 (A) \sqrt{f} (B) f
 (C) f^2 (D) none of these
67. Which of the following quantities increase when wavelength is increased? consider only the magnitudes.
 (A) the focal length of a converging lens (B) the focal length of both lenses
 (C) the power of a converging lens (D) the power of a diverging lens.
68. In Young's double slit experiment, if the widths of slit are in the ratio 4:9, ratio of intensity of maximum intensity of minima will be
 (A) 25:1 (B) 9:4 (C) 3:2 (D) 81:16
69. The oscillating electric and magnetic field vectors of an electromagnetic waves are oriented along
 (A) mutually perpendicular directions and are in phase
 (B) mutually perpendicular directions and differ in phase by 90
 (C) the same direction but differ in phase by 90
 (D) the same direction and are in

70. At a certain place, horizontal component is $\sqrt{3}$ times the vertical component. The angle of dip at this place is
 (A) 0 (B) 60
 (C) 30 (D) None of these.
71. Electromagnetic waves are produced by
 (A) an accelerating charge (B) a static charge
 (C) charge less particle (D) a moving charge.
72. Which of the following can be expressed in Coulomb?
 (A) $\oint \vec{B} \cdot d\vec{l}$ (B) $\oint \vec{E} \cdot d\vec{l}$
 (C) $\oint \epsilon_0 \vec{E} \cdot d\vec{s}$ (D) $\oint \frac{\vec{B}}{\mu_0} \cdot d\vec{s}$
73. The wavelength of microwave is
 (A) smaller than the wavelength of violet light
 (B) smaller than the wavelength of yellow light
 (C) larger than the wavelength of the red light
 (D) larger than the wavelength of radio waves.
74. Microwaves are electromagnetic waves with frequency
 (A) micro hertz (B) mega hertz
 (C) giga hertz (D) hertz
75. An accelerated electron would produce
 (A) alpha rays (B) beta rays
 (C) gamma rays (D) E.M. rays
76. If ϵ_0 and μ_0 are the electric permittivity and magnetic permeability in free space, ϵ and μ are the corresponding quantities in a medium, then index of refraction of the medium is
 (A) $\sqrt{\frac{\epsilon_0 \mu}{\epsilon \mu_0}}$ (B) $\sqrt{\frac{\epsilon}{\epsilon_0}}$
 (C) $\sqrt{\frac{\epsilon_0 \mu_0}{\epsilon \mu}}$ (D) $\sqrt{\frac{\epsilon \mu}{\epsilon_0 \mu_0}}$
77. Infrared spectrum lies between
 (A) radio wave and microwave region (B) microwave and visible region
 (C) visible and ultra violet region (D) ultra-violet and X-ray

78. The increasing order of the specific charge on (i) electron (e) (ii) proton (p) (iii) neutron (n) and (iv) alpha-particle (α) is
- (A) e, p, n, α (B) n, p, e, α
 (C) n, p, α , e (D) n, α , p, e
79. The cause of fractional atomic weights of elements is presence of
- (A) isobars (B) isotopes
 (C) isotones (D) isodiphères
80. In Thomson mass spectrograph, all positive ions with same specific charge lie on same
- (A) straight line (B) parabola
 (C) hyperbola (D) square
81. The wavelength of series limit of Lyman series is
- (A) ∞ (B) R
 (C) $\frac{1}{R}$ (D) $\frac{1}{4R}$
82. Consider the spectral line resulting from transition $n=2$ to $n=1$ in the atoms and ions given below. The shorter wavelength is given by
- (A) hydrogen atom
 (B) deuterium
 (C) singly ionized helium
 (D) doubly ionized helium
83. The half-life period of neutron is 13 minutes approximately. The intensity of neutron beam traveling in free space with a velocity of 30 km per sec is reduced to half when it cover a distance of
- (A) 23400 km (B) 11700 km
 (C) 46800 km (D) None
84. Which of the following radiations has the least wavelength?
- (A) β -rays (B) α -rays
 (C) x-rays (D) γ -rays
85. Magnetic field does not cause deflection in
- (A) γ -decays (B) β^- -decays
 (C) β^+ -decays (D) α -decays
86. In thermionic emission the thermionic current varies with temperature T of the filament as
- (A) T (B) T^2
 (C) $\frac{1}{T}$ (D) $\frac{1}{T^2}$

87. The amplification in triode valve is due to the presence of
 (A) anode (B) cathode
 (C) grid (D) filament.
88. The energy of the n -th state of the hydrogen atom is
 (A) $E_n = -13.2 n^2$ (B) $E_n = -13.6/n^2$
 (C) $E_n = 13.6n$ (D) $E_n = 13.2 n^2$
89. The hydrogen in the normal state is bombarded with electrons having kinetic energy 11.6 eV. The minimum kinetic energy of the electrons after bombardment
 (A) 1.5 eV (B) 1.4 eV
 (C) 11.6 eV (D) none of these
90. The relation between the frequency of the characteristic X-radiation and atomic number of the elements is known as Moseley's law. The correct mathematical relation is
 (A) $\nu = k^2(Z-b)^2$ (B) $\nu = k(Z-b)$ (C) $\nu^2 = k(Z-b)$ (D) none of these
91. The spacing of the (100) planes in calcite is 3.036 Å. The angle at which the first order diffraction maxima will be found for X-rays of wave length 1.537 Å is
 (A) 14.33 (B) 14.66 (C) 28.66 (D) none of these
92. Two photons approach each other with velocity c . What is their relative velocity
 (A) $2c$
 (B) $c/2$
 (C) $c/(1+c)$
 (D) c
93. A star of radius r and mass m contracts to a radius r' while its temperature remains unchanged. The expression for the energy radiated by the star, assuming the uniform density in each case is
 (A) $mc^2 [1-(r'/r)^3]$ (B) $mc^2 [1-(r/r')^3]$
 (C) $mc^2 [1+(r'/r)^3]$ (D) $mc^2 [1+(r/r')^3]$
94. Two lump of clay, each of rest mass m_0 , collide head on at $4c/5$ and stick together. The mass of the composite lump is
 (A) $m_0/3$ (B) $2m_0/3$ (C) $10m_0/3$ (D) none of these

95. How many photons of λ (in meter) must fall per sec on a blackened plate to produce a force of 1 dyne?
- (A) λ/h (B) $(\lambda \times 10^{-5})/h$
 (C) $(h \times 10^5)/\lambda$ (D) none of these
96. If the uncertainty in the location of a particle is equal to its de Broglie wavelength, the uncertainty in its velocity is
- (A) Velocity (B) Momentum
 (C) Energy (D) Time
97. The kinetic energy of an electron (rest mass m_0), having de Broglie wavelength equal to Compton wavelength is
- (A) $m_0 c/2$ (B) $m_0 c^2 [2^{1/2} - 1]$
 (C) $m_0 c [2^{1/2} - 1]$ (D) none of these
98. The ratio of the magnetic moment to the angular momentum of electron
- (A) e/m (B) $e/2m$
 (C) $m/2e$ (D) none of these
99. If mirror M2 in a Michelson's interferometer is moved through 0.233 mm, a shift of 792 fringes occurs. What is the wavelength of the light producing this fringe pattern?
- (A) 390 nm (B) 620 nm
 (C) 588 nm (D) 470 nm
100. A slit of width a is illuminated by white light. For what value of a will the first minimum for red light of wavelength 650 nm appear at $\theta = 30^\circ$?
- (A) $2.5 \mu\text{m}$ (B) $1.3 \mu\text{m}$
 (C) $2.6 \mu\text{m}$ (D) $1 \mu\text{m}$