T-15

Entrance Examinations – 2019

M.Sc. Ocean and Atmospheric Sciences

Hall Ticket No. _____

Time : 2 hours Max. Marks : 75

INSTRUCTIONS

i) Write your Hall Ticket Number in the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided above on the question paper booklet.

ii) The question paper consists of 100 objective type questions of one mark each. **There is negative marking of 0.33** for **each wrong answer.**

iii) The question paper consists of Part 'A' and Part 'B'.

iv) Answers are to be marked on the **OMR answer sheet** following the instructions provided there upon.

v) Hand over the OMR answer sheet at the end of the examination to the Invigilator.

vi) No additional sheets will be provided. Rough work can be done in the question paper itself/ space provided at the end of the booklet.

vii) Non-programmable calculators are allowed.

PART A

1. The work done if a gas expands against a constant pressure of 3 atmosphere from 5 litres to 22 litres is

A. 51.0 litres atm
B. 0.0 litres atm
C. -51.0 litres atm
D. 1.0 litre atm

2. What is the probability of getting a total of less than 12 in the throw of two dice?

A. $\frac{1}{36}$
B. $\frac{35}{36}$
C. $\frac{5}{6}$
D. $\frac{1}{6}$

3. The weight of a water bed is 1.18×10^4 N. When it, with its lower cross-section of $4.00m^2$ rests on the floor, the pressure exerted on the floor is 2.95×10^3 Pa. When the bed instead lies on its side with area of 0.4 m^2, the pressure will be

A. 2.95×10^3 Pa
B. 2.95×10^4 Pa
C. 1.45×10^4 Pa
D. 2.95×10^2 Pa

4. Which of the following is not a thermodynamic state function

A. Internal Energy
B. Heat
C. Volume
D. Enthalpy

5. The mean and variance of 7 observations are 8 and 16, respectively. If 5 of the observations are 2, 4, 10, 12, 14, then the remaining observations are

A. 0 and 16
B. 6 and 16
C. 6 and 8
D. 8 and 16

6. Earth's lower atmosphere is a good

A. absorber of infrared radiation
B. absorber of visible radiation
C. Both A and B
D. None of the above

7. The half-life time for the decomposition of a substance dissolved in CCl_4 is 2.5 hours at 30°C. How much of the substance will be left after 10 hours if the total weight of the substance is 160 gm?

A. 160 gm
B.10 gm
C. 80 gm
D. 1 gm

8. Three coins are tossed together. Probability of getting at least two heads

A. $\frac{1}{2}$
B. $\frac{1}{6}$
C. $\frac{1}{4}$
D. $\frac{1}{8}$

9. The number of 75W bulbs that can be operated in a circuit with a current of 20.0 A and operating voltage of 120 V is

A. 32
B. 75
C. 6
D. 1

10. Predict the reaction of 1 N sulphuric acid with the following metals: a) Copper b) Lead c) Iron. Given that E° Cu^{2+}, Cu = 0.34 volt; E° Pb^{2+}, Pb = -0.13 volt; E° Fe^{2+}, Fe = -0.44 volt.

A. not possible; possible; possible
B. all three reactions are not possible
C. possible; not possible; possible
D. all three reactions are possible

11. If $\cos p\theta = \cos q\theta, p \neq q, n \in Z$ then

A. $\theta = 2n\pi$
B. $\theta = \frac{2n\pi}{p+q}$
C. $\theta = \frac{2n\pi}{p-q}$
D. $\theta = \frac{2n\pi}{p \pm q}$

12. In a lightning strike, there is rapid movement of negative charge from cloud to ground. The lightning strike is deflected by earth's magnetic field is

A. upward
B. downward
C. all directions
D. westward

13. The phase rule states that

A. P + F = C + 2
B. P + F = C – 2
C. P + C = F + 2
D. P + C = F – 2

14. The value of $\sum_{i=0}^{n} \sum_{j=1}^{n} {}^{n}C_{j}\, {}^{j}C_{i}, i \leq j$ is

A. $1^n - 1$
B. $2^n - 1$
C. $3^n - 1$
D. $4^n - 1$

15. An engine with a Carnot efficiency of 30% expels its gases into atmosphere at 300 K temperature. After the combustion, the temperature in its cylinder will be

A. 90 K
B. 299 K
C. 429 K
D. 390 K

16. When large number of gases are dissolved in a given liquid at the same time, the law that states that amount of a gas dissolved in the liquid at constant temperature is proportional to its partial pressure is

A. Charles' Law
B. Henry's Law
C. Raoult's Law
D. Graham's Law

17. $\int x^x(1+\log x)dx =$
   A. $x^x(1+\log x)+c$
   B. x^x+c
   C. $e^{x^x}+c$
   D. None of these

18. The entropy change ΔS of a system that undergoes a reversible adiabatic process will
   A. > 0
   B. <0
   C. = 0
   D. insufficient data

19. According to the Debye-Huckel theory, the speed of an ion in an electric field is
   A. increased
   B. uninfluenced
   C. becomes zero
   D. decreased

20. The area bounded by the curves $y = x^2$ and $x = y^2$ is equal to
   A. $\frac{1}{3}$
   B. $\frac{1}{4}$
   C. $\frac{3}{4}$
   D. $\frac{4}{3}$

21. If 100 J of heat energy is concurrently supplied to three 1kg samples of iron, glass and water, all at 10°C, these can be ranked from lowest to highest temperatures as
   A. water, glass, iron
   B. iron, water, glass
   C. glass, water, iron
   D. water, iron, glass

22. The correct order for the first ionization potential (IE_1) of the elements Chlorine, Oxygen, Nitrogen, Fluorine, and Neon is
   A. Ne < F < Cl < O < N
   B. Cl < O < N < F < Ne
   C. Cl < O < Ne < F < N
   D. N < F < Cl < Ne < O

23. The derivative of $f(x) = \sin(\sin x^2)$ at $x = \sqrt{\frac{\pi}{2}}$ is
   A. π
   B. -1
   C. 1
   D. 0

24. A biconvex lens has radii of curvature of 20 cm each. If the refractive index of its material is 1.5, the focus length is

A. 10 cm
B. 40 cm
C. 30 cm
D. 20 cm

25. Which of the following relates to the photons both as wave motion and as stream of particles.

A. $E = mc^2$
B. Interference
C. Diffraction
D. $E = h\nu$

PART B

26. The determinant of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1^3 & 2^3 & 3^3 \\ 1^5 & 2^5 & 3^5 \end{bmatrix}$ is

A. 5!
B. 3!
C. 6!
D. 2!

27. Consider the two statements:
(i) Line spectra contains information about atoms
(ii) Band spectra contains information about molecules

A. Both (i) and (ii) are wrong
B. Both (i) and (ii) are correct
C. Only (i) is correct
D. Only (ii) is correct.

28. Which of the following does not characterise X-rays

A. The radiation can ionise gases
B. It causes ZnS to fluorescence
C. Deflected by electric and magnetic fields
D. Have wavelength shorter than UV rays

29. If the standard deviation (S.D.) of the data $x_1, x_2, x_3, \ldots, x_n$ is σ, then S.D. of the data $x_1 + a, x_2 + a, x_3 + a, \ldots, x_n + a$ is:

A. $\sigma + a$
B. $a\sigma$
C. $\sigma - a$
D. σ

30. In a Yong's double slit experiment, the separation between slits is 0.10 mm., the wave length of light used is 600 nm, and the interference pattern observed is on a screen 1 m away. The separation between the successive bright fringes is

A. 6 mm
B. 60 cm
C. 0.6 mm
D. 60 mm

31. The wavelength of a spectral line for an electronic transition is inversely related to

A. The number of electrons undergoing the transitions
B. The nuclear charge of the atom
C. The difference in the energy of the energy levels involved in the transition
D. The velocity of the electron undergoing the transition

32. The mean deviation about mean for the following data is

x_i	3	5	7	9	11	13
f_i	6	8	15	25	8	4

A. 2.09
B. 8
C. 8.09
D. 2

33. Which of the following statements is not always valid?

A. Curl of a gradient is zero
B. Gradient of a curl is zero
C. Divergence of curl is zero
D. $\nabla . fg = g . \nabla f + f . \nabla(g)$, where both f and are scalar fields

34. The longest mean free path stands for

A. N_2
B. H_2
C. O_2
D. Cl_2

35. The probability distribution of X is

X	0	1	2	3
$P(X)$	0.2	k	k	$2k$

A. Value of k is 0.25
B. Value of k is 0.20
C. Value of k is 0.50
D. Value of k is 0.10

36. If the earth stops rotating, the apparent value of the acceleration due to gravity on its surface will

A. increase everywhere
B. decrease everywhere
C. increase at some places and remain the same at some other places
D. remain the same everywhere

37. Hydrogen bonding is maximum in
    A. Ethanol
    B. Diethylether
    C. Ethyl chloride
    D. Triethylamine

38. If $f(x)$ is an increasing function and $g(x)$ is a decresing function such that $g(f(x))$ exist, then
    A. $g(f(x))$ is an increasing function
    B. $g(f(x))$ is a decreasing function
    C. nothing can be said
    D. $g(f(x))$ is a constant function

39. Which of the following is correct for an elastic collision?
    A. the initial kinetic energy is equal to the final kinetic energy
    B. the initial kinetic energy is more than the final kinetic energy
    C. the initial kinetic energy first increases and then decreases
    D. all of the above are possible

40. The valency of Cr in the complex $[Cr(H_2O)_4Cl_2]^+$ is
    A. 3
    B. 1
    C. 6
    D. 5

41. If $\vec{u} = \vec{a} - \vec{b}$, $\vec{v} = \vec{a} + \vec{b}$ and $|\vec{a}| = |\vec{b}| = 2$, then $|\vec{u} \times \vec{v}|$ is
    A. $2\sqrt{16 - (\vec{a}.\vec{b})^2}$
    B. $2\sqrt{4 - (\vec{a}.\vec{b})^2}$
    C. $\sqrt{16 - (\vec{a}.\vec{b})^2}$
    D. $\sqrt{4 - (\vec{a}.\vec{b})^2}$

42. A particle moves in a circular path with a continuously increasing speed. Its motion is
    A. Simple harmonic
    B. Periodic
    C. Oscillatory
    D. None of the above

43. Which of the following is a hard base according to the Lewis theory of hard and soft acids and bases
    A. I^-
    B. H^+
    C. SO_3
    D. OH^-

44. If $A = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$, then $A^{-1} + A^2 =$

A. $3A + I$
B. $3A - I$
C. $-3A + I$
D. $3I$

45. As the speed of a particle increases, its rest mass
A. increases
B. decreases
C. remains the same
D. changes

46. In which of the following forms, is iron present in haemoglobin?
A. Fe^{3+}
B. Fe^{2+}
C. Fe
D. All of the above

47. If $z = 1 + i$, then the argument of $z^2 e^{z-i}$ is
A. $\frac{\pi}{2}$
B. $\frac{\pi}{6}$
C. $\frac{\pi}{3}$
D. $\frac{\pi}{4}$

48. If a constant force acts on a particle, its acceleration will
A. remains constant
B. gradually decreases
C. gradually increases
D. none of them

49. Which one of the following is most basic?
A. NH_3
B. $(CH_3)_2NH$
C. $(C_6H_5)_3N$
D. $C_6H_5\ CH_2NH_2$

50. If number of students appeared in entrance exam increased from 1000 to 4000 in last 3 years. What was the average percentage increase per year?
A. 53.2%
B. 100%
C. 47.5%
D. 58.7%

51. The mass number of a nucleus is equal to
    A. the number of neutrons in the nucleus
    B. the number of protons in the nucleus
    C. the number of nucleons in the nucleus
    D. none of them

52. Which of the following does not exhibit aromaticity
    A. Pyrrole
    B. Furan
    C. Pyrrolidine
    D. Thiophene

53. If $f(x)$ is a 3rd order polynomial function $f: R \to R$ such that $f(2x) = f'(x).f''(x)$, then the value of $f(3)$ is
    A. 4
    B. 12
    C. 15
    D. 18

54. In a radioactive decay, neither the atomic number nor the mass number changes. Which of the following particles is emitted in the decay?
    A. proton
    B. neutron
    C. electron
    D. photon

55. The rate constant for a certain first order reaction is 1×10^{-5} sec^{-1}. The time taken for the completion of 20% of the reaction is
    A. 42.815 sec
    B. 2.2316 sec
    C. 9.4523 sec
    D. 1.1852 sec

56. If $\int_0^{\pi} xf(\sin x)dx = A\int_0^{\frac{\pi}{2}} f(\sin x)dx$, then A is
    A. 0
    B. 2π
    C. π
    D. none of the above

57. Planck constant has the same dimensions as
    A. force × time
    B. force × distance
    C. force × speed
    D. force × distance × time

58. Tartaric acid [CH(OH)COOH.CH(OH)COOH] can exist in
    A. Two optically active and two inactive forms
    B. Four optically active forms
    C. Four optically inactive
    D. Three optically active and one inactive form

59. $f(x) = \begin{cases} 3x - 8, & if\ x \leq 5 \\ 2k, & if\ x > 5 \end{cases}$ is continuous, find k value,
    A. $\frac{3}{7}$
    B. $\frac{7}{2}$
    C. $\frac{2}{7}$
    D. $\frac{4}{7}$

60. The minimum orbital angular momentum of the electron in a hydrogen atom is
    A. h
    B. $h/2$
    C. $h/2\pi$
    D. h/λ

61. Chiral molecules are those which are
    A. not superimposable in their mirror image
    B. are superimposable on their mirror image
    C. show geometrical isomerism
    D. are unstable molecules

62. If x is real, then the minimum value of $x^2 - 8x + 17$ is
    A. 2
    B. 4
    C. 1
    D. 3

63. At low temperature, body emits radiation of
    A. shorter wavelength
    B. high frequencies
    C. longer wavelength
    D. high energy

64. When H_2S is passes through an ammonical salt solution of X, a white precipitate is obtained. The X can be a
    A. Cobalt salt
    B. Nickel salt
    C. Manganese salt
    D. Zinc salt

65. If the sum of two unit vectors is also a unit vector, then the angle between the two unit vectors is

A. $\frac{\pi}{3}$
B. $\frac{\pi}{2}$
C. $\frac{\pi}{4}$
D. $\frac{2\pi}{3}$

66. Which phenomenon is best explained by the particle nature of light?

A. The Doppler Effect
B. Polarization
C. The Photoelectric effect
D. Interference

67. Which of the following ions gives a crimson colour in the flame test?

A. K^+
B. Ba^{2+}
C. Sr^{2+}
D. Ca^{2+}

68. The degree of the differential equation $\frac{dy}{dx} + \sin\left(\frac{dy}{dx}\right) = 0$ is

A. 0
B. 3
C. 1
D. None of the above

69. The energy of a photon varies directly with its

A. frequency
B. wavelength
C. speed
D. rest mass

70. Ethyl alcohol, when treated with conc. H_2SO_4 at 200°C forms

A. Ethyl hydrogen sulphate
B. Ethylene
C. Diethyl ether
D. Diethyl sulphate

71. If θ is small and positive number, then which of the following is correct?

A. $\frac{\sin\theta}{\theta} = 1$
B. $\theta < \sin\theta < \tan\theta$
C. $\frac{\tan\theta}{\theta} = \frac{\sin\theta}{\theta}$
D. None of the above

72. The radius of the first Bhor orbit is a_0. The n^{th} orbit has a radius
    A. na_0
    B. a_0/n
    C. n^2a_0
    D. a_0/n^2

73. Which of the following is the strongest acid
    A. HCOOH
    B. CH_3COOH
    C. $(CH_3)_2CHCOOH$
    D. $(CH_3)_3CCOOH$

74. How many significant figures are in the number 0.00120?
    A. 3
    B. 5
    C. 2
    D. 6

75. In general, the land cools down faster than the sea at night because
    A. the rise in temperature of the sea is higher than that of the land in the daytime.
    B. water has a high specific heat capacity.
    C. wind blows from the sea towards the land.
    D. wind blows from the land towards the sea.

University of Hyderabad

Entrance Examinations - 2019

School/Department/Centre : Physics/Earth, Ocean and Atmospheric Sciences

Course/Subject : M.Sc./Ocean and Atmospheric Sciences (Code No. T-15)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	A	26	C	51	C	76	
2	B	27	B	52	C	77	
3	B	28	C	53	B	78	
4	B	29	D	54	D	79	
5	C	30	A	55	B	80	
6	A	31	C	56	C	81	
7	B	32	A	57	D	82	
8	A	33	B	58	A	83	
9	A	34	B	59	B	84	
10	A	35	D	60	C	85	
11	D	36	C	61	A	86	
12	D	37	A	62	C	87	
13	A	38	B	63	C	88	
14	C	39	A	64	D	89	
15	C	40	A	65	D	90	
16	B	41	A	66	C	91	
17	B	42	D	67	C	92	
18	C	43	D	68	D	93	
19	D	44	B	69	A	94	
20	A	45	C	70	B	95	
21	A	46	B	71	A	96	
22	B	47	A	72	C	97	
23	D	48	B	73	A	98	
24	D	49	B	74	A	99	
25	D	50	D	75	B	100	

Note/Remarks : M.Sc. (Ocean and Atmospheric Sciences) entrance examination consists of 75 MCQs.

Signature

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