Code No. Z-15

ENTRANCE EXAMINATION, 2021

QUESTION PAPER BOOKLET

M.Sc. (OCEAN & ATMOSPHERIC SCIENCES)

Marks : 75
Time : 2:00 hrs.

Hall Ticket No.: _____

Read carefully the following instructions

i) Please enter your Hall Ticket Number on the OMR Answer Sheet given to you and the space provided above.

ii) This Question paper has two parts: **Part - A** and **Part - B**

iii) **Part - A** consists of 25 objective type questions and **Part - B** consists of 50 objective type questions. Each question carries one mark.

iv) **There is negative marking. Each wrong answer carries -0.33 marks.**

v) Answers are to be marked on the OMR answer sheet following the instructions provided there upon. An example is show here

75. (A) (B) (C) ●

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

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

viii) Only scientific non-programmable calculators are permitted. Mobile phone-based calculators are not permitted. Logarithmic tables are not allowed.

ix) This question paper booklet contains 13 pages.

PART - A

1. For a particle moving along x-axis, acceleration is given as $a = 2v^2$. If the speed of particle is v_0 at $x = 0$, find the speed as a function of x

A. $v = v_0 e^{-2x}$
B. $v = v_0 e^{2x}$
C. $v = \frac{e^x}{v_0}$
D. $v = \frac{e^{-x}}{v_0}$

2. The Pauli's exclusion principle applies to which of the following:

A. H
B. H^+
C. H^-
D. All of the above

3. Find the value of x, from the following:

$\begin{vmatrix} x & 4 \\ 2 & 2x \end{vmatrix} = 0$

A. 2
B. 4
C. ±2
D. ±4

4. Which of the following pairs represent units of the same physical quantity?

A. Kelvin and Joule
B. Joule and Calorie
C. Calorie and Kelvin
D. Calorie and Newton

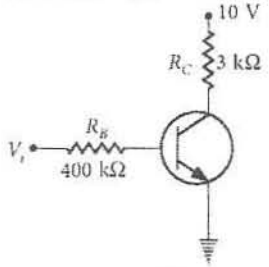
5. How many moles of O are present in 4.9 g of H_3PO_4? (Atomic weights of P=31; O=16; H=1)

A. 0.2 mole
B. 1 mole
C. 9.8 mole
D. 4.9 mole

6. If a and b are van der Waals constants, a gas will liquefy easily for:

A. Larger values of a and
B. Smaller values of a but larger values of b
C. Smaller values of a and b
D. Larger values of a but smaller values of b

7. In the circuit shown in figure, when the input voltage of the base resistance is 10 V, V_{BE} is zero and V_{CE} is also zero. Then current amplification factor of transistor is



A. 103
B. 83
C. 133
D. 93

8. If pressure at half the depth of a lake is equal to 2/3 of the pressure at the bottom of the lake, then, what is the depth of the lake? (Air pressure at lake's surface is $P_0 = 1.01 \times 10^5$ N m^{-2})

A. 10 m
B. 20 m
C. 60 m
D. 30 m

9. The number of d-electrons retained in Fe^{+2} (atomic number of Fe= 26) ion is:

A. 4
B. 5
C. 6
D. 3

10. The solution of a differential equation which is not obtained from the general solution is known as

A. Particular solution
B. Singular solution
C. Complete solution
D. Auxiliary solution

11. Three rods of length L of identical cross-sectional area made from the same metal form the sides of an isosceles triangle ABC right angled at B. The points A and B are maintained at temperatures T and $\sqrt{2}\,T$ respectively in the steady state. Assuming that only heat conduction takes place, temperature of point C will be

A. $\frac{T}{\sqrt{2}+1}$
B. $\frac{3T}{\sqrt{2}+1}$
C. $\frac{T}{\sqrt{2}-1}$
D. $\frac{2T}{\sqrt{2}+1}$

12. The equilibrium constant of a reaction is 300. If the volume of the reaction flask is tripled, the equilibrium constant will be

A. 100
B. 300
C. 150
D. 250

13. For what value of x the matrix $A = \begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$ is singular

A. 3
B. 5
C. 6
D. 9

14. The sun's surface temperature is about 6000 K. The sun's radiation is maximum at a wavelength of 0.5 μm. A certain light bulb filament emits radiation with a maximum at 2 μm. If both the surface of the sun and of the filament has the same emissive characteristics, what is the temperature of the filament?

A. 1000 K
B. 1200 K
C. 1500 K
D. 1600 K

15. Which of the following represents a redox reaction?

A. $NaOH + HCl \rightarrow NaCl + H_2O$
B. $BaCl_2 + H_2SO_4 \rightarrow Ba(SO_4)_2 + HCl$
C. $CuSO_4 2H_2O \rightarrow Cu(OH)_2 + H_2SO_4$
D. $Zn+2HCl \rightarrow ZnCl_2 + H_2$

16. If the total sum of square is 20 and the sample variance is 5, then total number of observations are

A. 15
B. 25
C. 4
D. 35

17. What is the percentage increase in the length of a wire of diameter 2.5 mm stretched by a force of 980 N? Young's modulus of elasticity of the wire is 12.5×10^{11} dyne cm^{-2}. ($1N = 98 \times 10^6$ dyne)

A. 0.10%
B. 0.12%
C. 0.20%
D. 0.16%

18. The bond order in NO is 2.5, while that in NO^+ is 3. Which of the following statement is true for these two species?

A. Bond length in NO^- is greater than in NO
B. Bond length in NO is greater than in NO^-
C. Bond length in NO^+ is equal to that in NO
D. None of the above

19. The direction cosines of a line, which makes equal angles with the coordinate axes are

A. $\pm\frac{1}{\sqrt{2}}, \pm\frac{1}{\sqrt{2}}, \pm\frac{1}{\sqrt{2}}$

B. $\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

C. $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{3}$

D. $-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$

20. Let a wire is placed in a magnetic field that varies with distance from origin as $B = B_0(1+\frac{x}{a})\hat{k}$. Ends of wire are at (a, 0) and (2a, 0) and it carries a current i. If force on wire is $F = B_0 i\left(\frac{Ka}{2}\right)(-\hat{j})$. Then, find the value of K.

A. 5

B. 7

C. 9

D. 11

21. The coordination number and the oxidation state of the element E in the complex $[E(en)_2(C_2O_4)]NO_2$ (where (en) is ethylene diamine) are, respectively

A. 6 and 2

B. 4 and 2

C. 4 and 3

D. 6 and 3

22. The distance of the plane $3x - 4y + 12z = 3$ from the origin is

A. $\frac{5}{13}$

B. $\frac{-5}{13}$

C. $\frac{-3}{13}$

D. $\frac{3}{13}$

23. Find the maximum height of mountain on Earth, if elastic limit for a typical rock is about 3×10^8 N m^{-2} and its density is 3000 kg m^{-3}

A. 15 km

B. 12 km

C. 8 km

D. 10 km

24. Which one of the following ores is best concentrated by the froth flotation method?

A. Siderite

B. Galena

C. Malachite

D. Magnetite

25. In a country of 1400 million population 70% own electronic vehicles. Among the vehicle owners only 294 million have the four-wheeler vehicles. Among these four wheelers users, only half uses the electric vehicles. What is the percentage of these electric vehicle users in the country?

A. 10.50
B. 14.70
C. 15.00
D. 50.00

PART - B

26. A coil has an inductance of 0.7 H and is joined in series with a resistance of 220 Ω. When an alternating emf of 220 V at 50 cycles per second, is applied to it, then wattless component of current in the circuit is

A. 5 A
B. 0.5 A
C. 7 A
D. 0.7 A

27. Given $E^0_{Fe^{3+}/Fe} = -0.036V$; $E^0_{Fe^{2+}/Fe} = -0.439V$. The value of standard electrode potential for the change $Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$ will be

A. -0.072V
B. 0.385V
C. 0.770V
D. -0.270V

28. The gradient of xi + yj + zk is

A. 0
B. 3
C. 2
D. 1

29. An α-particle and a proton are accelerated from rest through same potential difference and both enter into a uniform perpendicular magnetic field. The ratio of their radii of curvature is

A. $\sqrt{2} : 1$
B. $1 : \sqrt{2}$
C. 1 :
D. 2 : 1

30. The increasing order of atomic radii of the following Group 13 elements is

A. Al < Ga < In < Tl
B. Ga < Al < In < Tl
C. Al < In < Ga < Tl
D. Al < Ga < Tl < In

31. The scalar component of the vector $\underset{AB}{\rightarrow}$ with initial point $A(2,1)$ and terminal point $B(-5,7)$ are

A. (-7, 6)
B. (7, -6)
C. (-7, -6)
D. (7, 6)

32. The mutual inductance between two planar concentric rings of radii r_1 and r_2 (with $r_1 >> r_2$) placed in air is given by

A. $\frac{\mu_0 \pi r_2^2}{2r_1}$
B. $\frac{\mu_0 \pi r_1^2}{2r_2}$
C. $\frac{\mu_0 \pi (r_1+r_2)^2}{2r_1}$
D. $\frac{\mu_0 \pi (r_1+r_2)^2}{2r_2}$

33. The element with Z = 20 is

A. an alkali metal
B. an alkaline earth metal
C. a halogen
D. an inert gas

34. The radius as well as the height of a circular cone increases by 10% . The percentage increase in its volume is

A. 12.3
B. 22.2
C. 33.1
D. 66.3

35. The first member of the Paschen series in hydrogen spectrum is of wavelength 18800 Å. The shortest wavelength of Paschen series is

A. 8182 Å
B. 6560 Å
C. 9182 Å
D. 12850 Å

36. Sea water can be converted into fresh water by

A. Osmosis
B. Sedimentation
C. Reverse Osmosis
D. Diffusion

37. If $f(x)$ is an invertible function, the inverse of $f(x) = \frac{3x-2}{5}$ is

A. $\frac{5x-2}{3}$

B. $\frac{3x+2}{3}$

C. $\frac{3x-2}{5}$

D. $\frac{5x+2}{3}$

38. Torque, moment of inertia, and angular acceleration are the rotational analogues of the ---------, -------, and ----------, respectively, of Newton's second law

A. force, mass, translational acceleration

B. mass, force, translational speed

C. force, mass, translational speed

D. mass, momentum, translational acceleration

39. With reference to aqua regia choose the correct option

A. Reaction of gold with aqua regia produces an anion having Au in +3 oxidation state

B. Reaction of gold with aqua regia produces NO2 in the absence of air

C. The yellow colour of aqua regia is due to the presence of NOCl and Cl_2

D. Aqua regia is prepared by mixing conc. HCl and conc. HNO_3 in 3:1 (v/v) ratio

40. A fair die is rolled two times independently. Given that the outcome on the first roll is 1, the expected value of the sum of the two outcomes is

A. 4

B. 4.5

C. 3

D. 5.5

41. Acceleration due to gravity on the moon is about

A. twice that on the earth

B. one-sixth of that on the earth

C. half of that on the earth

D. one-third of that on the earth

42. If two neutrons are added to an element X, then it will get converted to its

A. Isotope

B. Isobar

C. Isotone

D. Remains same as X

43. A and B throw a pair of die turn by turn. The first to throw 9 is awarded a prize. If A starts the game, the probability of A getting the prize is

A. 9/17

B. 7/17

C. 9/19

D. 7/19

44. In order to keep a body moving in a circle, there exists a force on it that is directed toward the center of the circle. This force is known as

A. Centrifugal force
B. Centripetal force
C. Gravitational force
D. Magnetic force

45. The order of the oxidation state of the phosphorus atom in H_3PO2, H_3PO_4, H_3PO_3, and $H_4P_2O_6$ is

A. $H_3PO_3 > H_3PO_2 > H_3PO_4 > H_4P_2O_6$
B. $H_3PO_4 > H_3PO_2 > H_3PO_3 > H_4P_2O_6$
C. $H_3PO_4 > H_4P_2O_6 > H_3PO_3 > H_3PO_2$
D. $H_3PO_2 > H_3PO_3 > H_4P_2O_6 > H_3PO_4$

46. $\lim_{x\to\infty} \int_0^x \left(\frac{1}{\sqrt{1+t^2}} - \frac{1}{t}\right) dt$ is

A. log 2
B. log $\sqrt{2}$
C. log $2^{1/4}$
D. log $2^{1/5}$

47. Maximum current a battery of e.m.f 3.0 V and internal resistance 1.0 Ω is

A. 0.3 A
B. 3.0 A
C. 30.0 A
D. Insufficient data

48. The solid structure of NaCl belongs to which of the following structure

A. Single cubic
B. Tetragonal
C. Triclinic
D. Hexagonal

49. A partial differential equation requires

A. two or more independent variables
B. exactly one independent variable
C. more than one dependent variable
D. equal number of dependent and independent variables

50. The weight of an object is felt due to the gravity of the earth. When an object goes inside the earth or above the earth, its weight decreases. It will weigh minimum when an object is placed

A. at the equator of the earth
B. at north pole of the earth
C. within the surface of the earth
D. in an orbit around the earth

51. Which of the following has highest electron affinity?
A. F
B. Cl
C. Br
D. I

52. The unit vector in the direction of $\vec{a} = 2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$ is
A. 0
B. 1
C. $\frac{2}{7}\hat{\imath} + \frac{6}{7}\hat{\jmath} + \frac{3}{7}\hat{k}$
D. $\frac{2}{9}\hat{\imath} + \frac{6}{9}\hat{\jmath} + \frac{3}{9}\hat{k}$

53. The absorption of ink by plotting paper involves
A. viscosity of ink
B. capillary action phenomenon
C. diffusion of ink through the plotting
D. siphon action

54. The conjugate base of NH_4^+ is
A. NH_3
B. NH_4OH
C. OH^-
D. NH_2

55. Using principal value, the solution of $\sin^{-1}\left[\sin\frac{3\pi}{5}\right]$ is
A. $\frac{3\pi}{5}$
B. $\frac{2\pi}{5}$
C. $-\frac{3\pi}{5}$
D. $-\frac{2\pi}{5}$

56. Shiba kicks a soccer ball. It goes from 0 to 32 m/s in 0.1 seconds. What is the acceleration?
A. 300 m/s^2
B. 300 m/s
C. 320 m/s
D. 320 m/s^2

57. A molecule is divided into two halves, which are mirror images of each other, by
A. a centre of symmetry
B. a plane of symmetry
C. an axis of symmetry
D. none of these

58. If $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 2$, and $\vec{a}.\vec{b} = \sqrt{3}$; the angle between $\vec{a}$ and $\vec{b}$ is:

A. $\frac{\pi}{2}$
B. $\frac{\pi}{3}$
C. $\frac{3\pi}{2}$
D. $\frac{5\pi}{3}$

59. Energy required per unit mass of substance to raise temperature of that substance by 1 K is called

A. enthalpy
B. internal energy
C. specific heat capacity
D. temperature

60. The particle having a major role in binding the nucleus is

A. neutron
B. electron
C. meson
D. proton

61. The minor of the second row and third column of the determinant in the matrix

$$A = \begin{pmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{pmatrix} \text{ is}$$

A. 13
B. -13
C. 22
D. -22

62. Speed at which stars and galaxies are moving away from us is determined by phenomena of

A. Red shift
B. Blue shift
C. Yellow shift
D. White shift

63. The elements $^{30}Si_{14}$, $^{31}P_{15}$ and $^{32}S_{16}$ are called

A. Isotopes
B. Isobars
C. Isotones
D. Radioactive elements

64. The minimal polynomial of the matrix $\begin{pmatrix} 1 & 1 & 2 & 0 \\ 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 2 \end{pmatrix}$ is

A. $(x-1)(x-2)$
B. $(x-1)(x-2)^2$
C. $(x-1)^2(x-2)$
D. $(x-1)^2(x-2)^2$

65. Which of the following is a postulate of special relativity?

A. The laws of physics take the same form in all inertial frames of reference
B. Physicists can make no measurements in a moving reference frame
C. The relative speed of two objects is the same for all observers
D. All of the above

66. A plot of log [A] versus time (t) gives a straight line with a negative slope. The order of the reaction is

A. zero
B. 1
C. 2
D. 3

67. If A is a square matrix of order 3 and $|A| = 7$, then $|adj.A|$ is

A. 9
B. 49
C. 16
D. 4

68. Which of the following is incorrect in light of Joule-Thomson effect?

A. Temperature changes with expansion of a gas, but without exchange of work on environment
B. Slight cooling may occur to overcome to attraction between the gas molecules as they move away
C. It is about the change in temperature with expansion of a gas, with exchange of heat with environment
D. Hydrogen gas will cool upon expansion only if the initial temperature were very low

69. Which of the molecules will not show an infrared spectrum?

A. H_2
B. HCl
C. CH_4
D. H_2O

70. The solution of the integral $\int_0^1 \frac{1}{1+x^2} dx$ is

A. $\frac{\pi}{2}$
B. $\frac{\pi}{4}$
C. $\frac{\pi}{3}$
D. $\frac{\pi}{6}$

71. What is Half life?

A. The time taken by electron to approach half of its existence period
B. The amount of time required for half of a quantity of a radioactive element to decay
C. The time in which electrons of an atom lose half of their spin velocity
D. The amount of time required for the electrons to move from one shell to another

72. A positive catalyst increases the rate of reaction by
   A. lowering the activation energy
   B. providing an alternative path of lower alternative energy
   C. increasing the activation energy
   D. providing an alternative path of higher alternative energy

73. The intercept cut off by the plane $2x + y - z = 5$ on x-axis is
   A. 5
   B. -5
   C. $\frac{5}{2}$
   D. $\frac{-5}{2}$

74. An air bubble in water will act like a
   A. Convex mirror
   B. Convex lens
   C. Concave mirror
   D. Concave lens

75. If $y = y(x)$ is the solution of the differential equation $\frac{5+e^x}{2+y}\frac{dy}{dx} + e^x = 0$ satisfying $y(0) = 1$, then a value of $y(\log_e 13)$ is
   A. 1
   B. -1
   C. 0
   D. 2

Code No. Z-15

UNIVERSITY OF HYDERABAD

ENTRANCE EXAMINATION, 2021

QUESTION PAPER BOOKLET

M.Sc. (OCEAN & ATMOSPHERIC SCIENCES)

PART A	PART B	
1. B	26. B	51. B
2. C	27. C	52. C
3. C	28. B	53. B
4. B	29. A	54. A
5. A	30. B	55. B
6. D	31. A	56. D
7. C	32. A	57. B
8. B	33. B	58. B
9. C	34. C	59. C
10. B	35. A	60. C
11. A	36. C	61. A
12. B	37. D	62. A
13. A	38. A	63. C
14. C	39. D	64. C
15. D	40. B	65. A
16. C	41. B	66. B
17. D	42. A	67. B
18. B	43. A	68. C
19. C	44. B	69. A
20. A	45. C	70. B
21. D	46. A	71. B
22. D	47. B	72. A
23. D	48. A	73. C
24. B	49. A	74. D
25. A	50. D	75. B