Entrance Examinations – 2018
M.Sc. Ocean and Atmospheric Sciences

Hall Ticket No.

Time : 2 hours

Max. Marks : 100

INSTRUCTIONS

1. 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.
2. The question paper consists of 100 objective type questions of one mark each. **There is negative marking of 0.33** for **each wrong answer.**
3. The question paper consists of Part 'A' and Part 'B'.
4. Answers are to be marked on the **OMR answer sheet** following the instructions provided there upon.
5. Hand over the OMR answer sheet at the end of the examination to the Invigilator.
6. No additional sheets will be provided. Rough work can be done in the question paper itself/ space provided at the end of the booklet.
7. Non-programmable calculators are allowed.

PART A

1. Rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 3 & 2 & 1 \end{bmatrix}$ is

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

2. The work done by all the forces (external and internal) on a system equals the change in

A. total energy
B. kinetic energy
C. potential energy
D. none of these

3. In a C-H bond type, the bond length will be minimum for which of the following?

A. sp^3-s
B. sp^2-s
C. sp-s
D. equal for all of the above

4. If a_{ij} (i,j= 1,2,3,....n) are the elements of a diagonal matrix A, then the determinant of the matrix A is

A. $a_{11}+a_{22}+a_{33}+\ldots\ldots.+a_{nn}$

B. $a_{11}\times a_{22}\times a_{33}\times\ldots\ldots.\times a_{nn}$

C. $a_{11}\times a_{12}\times a_{13}\times\ldots\ldots.\times a_{1n}$

D. $a_{11}\times a_{21}\times a_{31}\times\ldots\ldots.\times a_{n1}$

5. Number of protons in an atom determine

A. chemical properties

B. physical properties

C. magnetic properties

D. electrical properties

6. Which of the following is not an example of electrophilic reagent?

A. BF_3

B. Br^+

C. SO_3

D. H_2O

7. If the length of vector $\vec{v} = \hat{\imath} + \hat{\jmath} + c\hat{k}$ is 2 then the value of c is

A. $\sqrt[2]{2}$

B. $-\sqrt[2]{2}$

C. $\sqrt[3]{2}$

D. $\pm\sqrt[2]{2}$

8. Work done on an object to bring it to certain point in space is called

A. gravitational potential energy

B. potential energy

C. kinetic energy

D. mechanical energy

9. The correct order of the decreasing acidic strength of fatty acids mentioned below is

A. $HCOOH > n\text{-}C_3H_7COOH > C_2H_5COOH > CH_3COOH$

B. $CH_3COOH > n\text{-}C_3H_7COOH > HCOOH > C_2H_5COOH$

C. $HCOOH > CH_3COOH > C_2H_5COOH > n\text{-}C_3H_7COOH$

D. $CH_3COOH > C_2H_5COOH > n\text{-}C_3H_7COOH > HCOOH$

10. The imaginary part of the $z = \frac{1}{i^2-3i}$ equals

A. 0

B. 1/2

C. 1/4

D. 1/3

11. The quantity pV/kT represents

A. mass of the gas

B. kinetic energy of the gas

C. number of moles of the gas

D. number of molecules in the gas

Q-15

12. An alkene on ozonolysis, gives CH_3CH_2CHO and HCHO. The structure of the alkene is
   A. $CH_3CH_2{=}CH_2$
   B. $CH_3CH_2CH{=}CH_2$
   C. $CH_3CH_2{=}CH_2CH_2$
   D. $CH_2{=}CH_2CH_3$

13. If A={1,3,5,7,9,11} and B={3,4,5,6} then $A \cap B$ equals to
   A. {3,5}
   B. {1,7,9,11}
   C. {4,6}
   D. {1,3,4,5,6,7,9,11}

14. The first law of thermodynamics is a statement of
   A. conservation of heat
   B. conservation of work
   C. conservation of momentum
   D. conservation of energy

15. Which is not an example of meta–Directing group on the benzene nucleus?
   A. $-SO_2OH$
   B. -CHO
   C. -CH=CHCOOH
   D. CCl_3

16. If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ then $\|\nabla(1/r)\|$ is
   A. $1/r^2$
   B. $1/r$
   C. $1/r^3$
   D. r^2

17. If a student drops a stone from a cliff of height 30 m and time it takes to reach ground is 2.6 s, then acceleration due to gravity is
   A. 9 m/s^2
   B. 10 m/s^2
   C. 4 m/s^2
   D. 8.8 m/s^2

18. The correct order of decreasing aromatic character is represented by
   A. Benzene > Naphthalene > Anthracene
   B. Naphthalene > Benzene >Anthracene
   C. Anthracene > Naphthalene > Benzene
   D. Benzene > Naphthalene =Anthracene

19. Given a sequence with general term $x[k] = \frac{3k^2-5k+6}{k^2+2k+1}$, then the value of $\lim_{k\to\infty} x[k]$ is
   A. 1
   B. 3
   C. 4
   D. 6

20. In a room containing air, heat can go from one place to another
    A. by conduction only
    B. by convection only
    C. by radiation only
    D. by all the three modes

21. Haemoglobin forms quite stable compounds with
    A. O_2
    B. CO
    C. H_2O
    D. both

22. Given $f(t) = 2t$, $g(t) = t-1$, and $h(t) = t^2$, then $f(g(h(t)))$ is
    A. $2t^2-1$
    B. $2(t-1)^2$
    C. $2(t^2-1)$
    D. $(2t-1)^2$

23. Two resistors A and B have resistances R_A and R_B, respectively with $R_A<R_B$. The resistivities of their materials are ρ_A and ρ_B.
    A. $\rho_A > \rho_B$
    B. $\rho_A = \rho_B$
    C. $\rho_A > \rho_B$
    D. the information is not sufficient to find the relation between ρ_A and ρ_B.

24. Nitrobenzene on reaction with tin and hydrochloric acid gives
    A. hydrazobenzene
    B. aminobenzene
    C. phenylhydroxylamine
    D. nitrosobenzene

25. The integral $I = \int \frac{e^x}{1+e^{2x}} dx$ is equal to (c is an integral constant)
    A. $\tan^{-1}(e^x) + c$
    B. $\tan(e^{2x}) + c$
    C. $\tan(e^x) + c$
    D. $\tan^{-1}(e^{2x}) + c$

PART B

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

27. Which is most reactive compound amongst the following?
    A. Furan
    B. Thiophene
    C. Pyrrole
    D. Benzene

Q-15

28. The area of the parallelogram spanned by the vectors $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ and $-\hat{\imath} - \hat{k}$ is

A. $3\sqrt[2]{2}$
B. $2\sqrt[2]{2}$
C. $3\sqrt[2]{3}$
D. $2\sqrt[2]{3}$

29. During a nuclear fission reaction

A. a heavy nucleus break into two fragments by itself
B. a light nucleus bombarded by thermal neutrons breaks up
C. a heavy nucleus bombarded by thermal neutrons break up
D. two light nuclei combine to give a heavier nucleus and possibly other products

30. Which one of the following statement is not true about glucose?

A. It reduces Tollen's reagent
B. It is sweeter than fructose
C. It's aqueous solution shows mutarotation
D. It is dextro-rotatory

31. If $\alpha, \beta \in C$ are the distinct roots, of the equation $x^2 - x + 1 = 0$, then $\alpha^{101} + \beta^{107}$ is equal to

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

32. A capacitor of capacitance C is charged to a potential V. The flux of the electric field through a closed surface enclosing the capacitor is

A. CV/ε_0
B. $2CV/\varepsilon_0$
C. $V/2\varepsilon_0$
D. Zero

33. Protein molecules contain

A. only α-amino acids
B. α-, β- and γ- amino acids
C. both α-and β-amino acids in equal proportions
D. only β-amino acids

34. A bag contains 3 red and 5 black balls. A ball is drawn at random from the bag, its colour is observed and this ball along with two additional balls of the same colour are returned to the bag. If now a ball is drawn at random from the bag, then the probability that this drawn ball is red, is

A. 5/8
B. 3/8
C. 3/10
D. 5/10

Q-15

35. In an elastic collision

A. the initial kinetic energy is equal to the final kinetic energy
B. the final kinetic energy is less than the initial kinetic energy
C. the kinetic energy remains constant
D. the kinetic energy first increases then decreases

36. The correct order of decreasing ionic size is

A. $Mg^{2+} > O^{2-} > Na^{+} > F^{-} > N^{3-}$
B. $N^{3-} > O^{2-} > F^{-} > Na^{+} > Mg^{2+}$
C. $O^{2-} > Na^{+} > F^{-} > N^{3-} > Mg^{2+}$
D. $F^{-} > O^{2-} > Na^{+} > Mg^{2+} > N^{3-}$

37. If $x = \sin t + \cos t$ and $y = t^1 - t + 1$, then $\frac{dy}{dx}$ $(t = 0)$ equals to

A. 2
B. −1
C. 1
D. −2

38. Gradual decrease in x-ray beam intensity as it passes through material is called

A. attenuation
B. decay
C. radioactivity
D. imaging

39. Which of the gases form clathrates or caged compounds?

A. Helium
B. Neon
C. Argon
D. Hydrogen

40. Given that y satisfies the equation $\frac{dy}{dx} + \frac{y^2}{2} = xy$, $y(1)=2$, the values of $\frac{d^2y}{dx^2}$ at $x=1$ is

A. 1
B. −2
C. 0
D. 2

41. Speed of sound in air is

A. 280 m/s
B. 300 m/s
C. 350 m/s
D. 330 m/s

42. The magnetic moment for an element having one unpaired electron (n =1) is

A. 1.73 BM
B. 2.86 BM
C. 1.93 BM
D. 1.37 BM

Q-15

43. A function y, and its first derivative are evaluated at x=2, y(2)=1 and $\frac{dy}{dx}=3$ at x=2. The first-order Taylor polynomial expression is

A. $3x-5$
B. $3x-1$
C. $5x+2$
D. $3x+5$

44. Only force acting on a bouncing ball is

A. gravity
B. weight of ball
C. friction
D. Both A and B

45. The highest oxidation state is shown by transition element with outermost electronic configuration as

A. d^6s^2
B. d^5s^1
C. d^5s^2
D. d^3s^2

46. Value of $\lim_{n\to\infty}\frac{n!}{(n+1)!-n!}$ is

A. 1
B. 0
C. -1
D. None of these

47. If we add salt to the pure water, its boiling point will

A. increase
B. decrease
C. remain same
D. none of these

48. If M is an element of lanthanide series, during lanthanide contraction

A. Size of M^{3+} ions decreases
B. Atomic radii increases
C. Size of M^{4+} ions decreases
D. Size of M^+ ions decreases

49. The 3rd term of expansion of $(1-2x)^{1/2}$

A. $\frac{1}{2}x^2$
B. x
C. $-x^2$
D. $-\frac{1}{2}x^2$

50. According to Horke's law of elasticity, within elastic limits, if the stress is increased, the ratio of stress to strain

A. Increases
B. Decreases
C. Becomes zero
D. Remains constant

51. The froth floatation process in Metallurgy is especially suitable for

A. Carbonate ore
B. Halide ore
C. Sulphide ores
D. Sulphate ores

52. If $xy = e - e^y$, then $\left(\frac{d^2y}{dx^2}\right)_{x=0}$ equals

A. $1/e$
B. $1/e^2$
C. $1/e^3$
D. $1/e^4$

53. For a constant volume gas thermometer, one should fill the gas at

A. low temperature and low pressure
B. low temperature and high pressure
C. high temperature and low pressure
D. high temperature and high pressure

54. $[Fe(CN)_6]^{4-} + H_2O_2 \xrightarrow{\text{acidic media}} [Fe(CN)_6]^{3-}$

In the above redox reaction equation, the change in oxidation number of Fe is

A. +2 to +3
B. +1 to +2
C. +2 to +4
D. 0 to +1

55. The sum of the arithmetic series containing 30 terms, $s_k = 1 + 5 + 9 + \cdots$, is

A. 1770
B. 1077
C. 1070
D. 7170

56. The absorption of ink by blotting paper involves

A. Viscosity of ink
B. Capillary action phenomenon
C. Diffusion of ink through the blotting
D. None of the above

57. Which of the following is hexadentate ligand

A. Ethylenediamine
B. 2,2'-Dipyridyl
C. Ethylenediaminetetracetate ion
D. all of the above

Q-15

58. Maxima of the functions $y(t) = -t^2 + t + 1$, exists at
   A. 0
   B. 1
   C. -0.5
   D. 0.5

59. Light from the Sun reaches us in nearly
   A. 2 minutes
   B. 4 minutes
   C. 8 minutes
   D. 16 minutes

60. Which of the following is a soft Lewis base
   A. H^+
   B. BF_3
   C. F^-
   D. I^-

61. Two dice are thrown simultaneously. The probability of obtaining a total score of 7 is
   A. $1/8$
   B. $1/6$
   C. $1/36$
   D. $1/7$

62. Stars appear to move from east to west because
   A. all stars move from east to west
   B. the earth rotates from west to east
   C. the earth rotates from east to west
   D. None of the above

63. Most abundantly distributed natural gas is
   A. Methane
   B. Oxygen
   C. Butane
   D. Hydrogen

64. The mean deviation about median from the following data 340, 150, 210, 240, 300, 310, 320 is
   A. 52.8
   B. 58.2
   C. 50.8
   D. 50.2

65. Metals are good conductors of electricity because
   A. they contain free electrons
   B. the atoms are lightly packed
   C. they have high melting point
   D. all of the above

66. Which is the reducing agent in the below ionic reaction

$MnO_4^- + C_2O_4^{2-} \xrightarrow{H^+} 2CO_2 + Mn^{2+}$

A. MnO_4^-
B. $C_2O_4^{2-}$
C. CO_2
D. Mn^{2+}

67. 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. 5 and 8
B. 6 and 7
C. 6 and 8
D. 5 and 7

68. What will be the amount of $^{128}I_{53}$ ($t_{1/2}$ = 25 minutes) left after 50 minutes?

A. one-half
B. one-fifth
C. one-fourth
D. one-third

69. Which one of the following is a scalar quantity?

A. force
B. pressure
C. velocity
D. acceleration

70. General solution of the equation $\cot\alpha - \tan\alpha = 2$ is

A. $\frac{n\pi}{2} + \frac{\pi}{4}$
B. $\frac{n\pi}{2} + \frac{\pi}{8}$
C. $\frac{n\pi}{4} \pm \frac{\pi}{8}$
D. none of these

71. Density of water in kg/m^3 is

A. 1000
B. 100
C. 10
D. 1

72. Which of the following rate laws has an overall order of 0.5 for the reaction involving substances *X, Y, Z*

A. Rate = $k[C\,x]\,[C\,y]^0\,[C\,z]^2$
B. Rate = $k[C\,x]^{0.5}\,[C\,y]^{0.5}\,[C\,z]^{0.5}$
C. Rate = $k[C\,x]^{1.5}\,[C\,y]^{-1}\,[C\,z]^0$
D. Rate = $k[C\,x]\,[C\,y]\,[C\,z]$

73. The equation sin (x) cos $(x) = 2$ has
   A. one solution
   B. two solutions
   C. infinite solutions
   D. no solutions

74. Sir C. V. Raman was awarded Nobel Prize for his work connected with which of the following phenomenon of radiation
   A. Scattering
   B. Diffraction
   C. Interference
   D. Polarization

75. Two moles of an ideal gas expand spontaneously into vacuum. The work done is
   A. infinity
   B. 2 J
   C. 4 J
   D. zero

76. For the function $y = \frac{1}{t}$, the derivative does not exists for $t =$
   A. ∞
   B. -1
   C. 1
   D. 0

77. A charged particle is moved along a magnetic field line. The magnetic force on the particle is
   A. along its velocity
   B. opposite to its velocity
   C. perpendicular to its velocity
   D. zero

78. In an exothermic reaction, where H_R= Heat of the Reactant; H_P = Heat of the Product, which of the following holds true?
   A. $H_R = H_P$
   B. $H_R > H_P$
   C. $H_R < H_P$
   D. $H_R \approx H_P$

79. If $\int f(x) \sin x \cos x \, dx = \frac{1}{2(b^2-a^2)} \log(f(x)) + c$, then $f(x)$=
   A. $\frac{tan^2 x}{b^2+a^2 \sec^2 x}$
   B. $\frac{tan^2 x}{a^2+b^2 \sec^2 x}$
   C. $\frac{\sec^2 x}{b^2+a^2 \tan^2 x}$
   D. $\frac{sec^2 x}{a^2+b^2 \, tan^2 x}$

80. In a transformer, alternating current is induced in
   A. primary coil
   B. secondary coil
   C. iron core
   D. resistor

81. The equation for the variation of heat of reaction with temperature has been given by
   A. Helmholtz
   B. Gibbs
   C. Kirchhoff
   D. Hess

82. If $\omega, \omega^2, \ldots\ldots, \omega^{n-1}$ are, n^{th} roots of unity, the value of $(9-\omega)(9-\omega^2)\ldots\ldots(9-\omega^{n-1})$ will be
   A. $(9^n + 8)/9$
   B. $(9^n - 8)/9$
   C. $(9^n - 1)/8$
   D. $(9^n + 1)/8$

83. In order to keep a body moving in a circle, there exists a force on it that is directed toward center of circle. This force is known as
   A. Centrifugal force
   B. Centripetal force
   C. Gravitational Force
   D. magnetic force

84. A triple point is the temperature where
   A. Three components are in equilibrium
   B. Three phases are in equilibrium
   C. The number of degrees of freedom are 3
   D. None of the above

85. The area bounded by the curve $y = x^3$, x-axis and two ordinates $x = 1$ to $x = 2$ equal to
   A.15/2 sq. unit
   B. 15/4 sq. unit
   C. 17/2 sq. unit
   D. 17/4 sq. unit

86. Ratio of stress to strain is
   A. Young's modulus
   B. shear stress
   C. stiffness
   D. tensile force

87. The law which states that amount of gas dissolved is proportional to its partial pressure is
   A. Graham's law
   B. Charle's law
   C. Henry's law
   D. Boyle's law

88. If $f(x) = a \log_e|x| + bx^2 + x$ has extremums at x=1 and x=3 then

A. $a = -\frac{3}{4}, b = -\frac{1}{8}$

B. $a = \frac{3}{4}, b = -\frac{1}{8}$

C. $a = -\frac{3}{4}, b = \frac{1}{8}$

D. $a = \frac{3}{4}, b = \frac{1}{8}$

89. Force acting on two point masses is directly proportional to

A. sum of masses

B. difference of masses

C. distance between masses

D. product of masses

90. The units of specific conductance in CGS system are

A. cm^2 ohm^{-1}

B. cm ohm^{-1}

C. ohm^{-1} cm^{-1}

D. cm^{-2} ohm^{-1}

91. The variance of a symmetric binomial distribution with mean 5 is

A. 2/5

B. 5/2

C. 3/2

D. 2/3

92. Speed of sound in water is 1500 m/s, depth of water when reflected sound waves are detected after 0.4 s is

A. 700 m

B. 600 km

C. 600 m

D. 750 km

93. The conductance of electrolyte

A. decreases with increase in temperature

B. increases with increase in temperature

C. does not get effected with change in temperature

D. none of the above

94. Let $\frac{d}{dx}\left(f(x)\right) = \frac{e^{\sin x}}{x}$, x> 0. If $\int_1^4 \frac{2e^{\sin x^2}}{x} dx = f(k) - f(1)$, a possible value of k is

A. – 4

B. 2

C. 4

D. 16

95. The mass of the Earth, whose radius is 6400 km and gravitational field strength is 9.81 N kg^{-1}, is

A. 6.0×10^{24} kg
B. 5×10^{23} kg
C. 40×10^{9} kg
D. 9×10^{24} kg

96. The standard potential of Cu/Cu^{2+} electrode is 0.338 volt. It corresponds to the reaction

A. $Cu^{2+} + 2e^- \longrightarrow Cu$
B. $1/2Cu + e^- \longrightarrow 1/2Cu$
C. $Cu \longrightarrow Cu^{2+} + 2e^-$
D. None of the above

97. If $(2x - 2y + 5)dy = (x - y + 3)dx$, then $\log(x - y + 2)$ equals

A. $x - 2y + c$
B. $2x - y + c$
C. $-x + 2y + c$
D. $-x + y + c$

98. Total number of magnetic field lines passing through an area is called

A. magnetic flux density
B. magnetic flux
C. E.M.F
D. voltage

99. What will be the mass of 5 mole of SO_2, given that molecular mass of SO_2 = 64 gm

A. 12.8
B. 320
C. 69
D. 64

100. Cosine is

A. an even function
B. an odd function
C. a Dirac Delta function
D. none of the above