

ENTRANCE EXAMINATION 2014
M.Sc. Ocean and Atmospheric Sciences

Date: 05.02.2014

Marks: 75

Instructions for the candidates:

1. All questions carry equal marks.
2. Write your Hall Ticket Number in the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided above.
3. **There is negative marking. Every wrong answer carries 0.33 mark.**
4. Hand over the OMR answer sheet at the end of the examination to the Invigilator.
5. No additional sheets will be provided. Rough work can be done in the question paper itself / space provided at the end of the booklet.
6. Non-programmable calculators are allowed.

PART - A

1. In variable state, the rate of flow of heat is controlled by
(A) density of material (B) thermal conductivity
(C) specific heat (D) all the above factors
2. The amount of radiation emitted by a perfectly black body is proportional to
(A) Temperature on ideal gas scale
(B) Fourth power of temperature on ideal gas scale
(C) Fourth root of temperature on ideal gas scale
(D) Source of temperature on ideal gas scale
3. Which element has the highest first ionization energy
(A) Sodium (B) Aluminum (C) Calcium (D) Phosphorus
4. If a source of light is moving away from a stationary observer, then the frequency of light wave appears to change because of
(A) Doppler's effect (B) Diffraction
(C) Interference (D) None of these
5. The isomerism which exists between CH_3CHCl_2 and $\text{CH}_2\text{Cl} \cdot \text{CH}_2\text{Cl}$ is
(A) chain isomerism (B) functional group isomerism
(C) positional isomerism (D) metamerism
6. The high reactivity of fluorine is due to
(A) its high electro negativity (B) small size of fluorine atom
(C) availability of d-orbitals (D) strong F - F bond

7. Two coherent sources of light can be obtained by
(A) Two different lamps
(B) Two different lamps of same power and having the same colour
(C) Two different lamps but of the same power
(D) None of the above
8. The physical quantity that has no dimensions
(A) Angular Velocity (B) Angular momentum
(C) Linear momentum (D) Strain
9. When two ends of a rod wrapped with cotton are maintained at different temperatures and after some time every point of the rod attains a constant temperature, then
(A) Conduction of heat at different points of the rod stops because the temperature is not increasing
(B) Heat is being radiated from each point of the rod
(C) Rod is bad conductor of heat
(D) Each point of the rod is giving heat to its neighbour at the same rate at which it is receiving heat
10. The first law of thermodynamics is concerned with the conservation of
(A) Momentum (B) Mass
(C) Energy (D) Temperature
11. Compressed air in the tube of a wheel of a cycle at normal temperature suddenly starts coming out from a puncture. The air inside
(A) Starts becoming hotter (B) Starts becoming cooler
(C) Remains at the same temperature
(D) May become hotter or cooler depending upon the amount of water vapour present
12. Select the pair whose dimensions are same
(A) Pressure and stress (B) Pressure and force
(C) Stress and strain (D) Power and force
13. The coefficient of thermal conductivity depends upon
(A) Temperature difference of two surfaces (B) Thickness of the plate
(C) Area of the plate (D) Material of the plate
14. The organic reaction represented by equation $\text{CH}_3 - \text{CH} = \text{O} + \text{H}_2\text{NOH}$ gives $\text{CH}_3 - \text{CH} - \text{NH} + \text{H}_2\text{O}$ is an example of
(A) an addition reaction (B) a condensation reaction
(C) an oxidation reaction (D) an elimination reaction
15. The mass of one Avogadro number of helium atom is
(A) 1.00 gr (B) 4.00 gr (C) 8.00 gm (D) $4 \times 6.02 \times 10^{23}$ gr
16. It is easy to wash clothes in hot water because its
(A) Surface tension is more (B) Surface tension is less
(C) Consumes less soap (D) None of these
17. Cohesive force is experienced between
(A) Magnetic substances (B) Molecules of same substances
(C) Molecules of different substances (D) None of these
18. If a glass rod is dipped in mercury and withdrawn out, the mercury does not wet the rod because
(A) Angle of contact is acute (B) Adhesion force is more
(C) Cohesion force is more (D) Density of mercury is more

19. The points (-3,3), (0,0) and (5,5) represents the vertices of a triangle
 (A) Equilateral (B) scalene (C) Right angled (D) Isosceles
20. Equation of line passing through (-2,3) and parallel to $x-3y+17=0$ is
 (A) $3x+y+3=0$ (B) $x-3y+3=0$ (C) $3x+y+11=0$ (D) $x-3y+11=0$
21. The height of rectangles in a histogram having class intervals of equal size is proportional to
 (A) Class frequencies (B) width of class intervals
 (C) Total frequency (D) None of these
22. A large volume of data can best be summarized pictorially by
 (A) Frequency table (B) Histogram (C) Range (D) none of these
23. A ladder is placed against a wall of height 18 m. If the top of the ladder makes an angle 60° with the wall then the height of the ladder is
 (A) 36 m (B) $12\sqrt{3}$ (C) $18\sqrt{3}$ (D) 48
24. The number of elements in the set $\{5, \{3,6\}, \{7,8\}, 10,11\}$ is
 (A) 3 (B) 4 (C) 5 (D) 7
25. 50th percentile of a distribution coincides with
 (A) Mean (B) Median (C) Mode (D) 3rd quartile

PART B

26. Which of the following equation does not represent a simple harmonic motion
 (A) $y = a \sin \omega t$ (B) $y = a \sin \omega t + b \cos \omega t$
 (C) $y = a \cos \omega t$ (D) $y = a \tan \omega t$
27. If an observer is walking away from the plane mirror with 6 m / sec, then the velocity of the image with respect to observer will be
 (A) 6 m / sec (B) 12 m / sec
 (C) - 6 m / sec (D) 3 m / sec
28. The potential of a hydrogen electrode at pH = 10 is
 (A) 0.59 V (B) 0.00V (C) -0.59 V (D) -0.059 V
29. When a bus suddenly takes a turn, the passengers are thrown outwards because of
 (A) Inertia of motion (B) Speed of motion
 (C) Acceleration of motion (D) Both (B) and (C)
30. A jet engine works on the principle of
 (A) Conservation of mass (B) Conservation of linear momentum
 (C) Conservation of energy (D) Conservation of angular momentum
31. Identify the correct statement from the following in a chemical reaction
 (A) The entropy always increases
 (B) The change in entropy along with suitable change in enthalpy decides the fate of a reaction
 (C) The enthalpy always decreases
 (D) The enthalpy always increases
32. Newton's first law of motion describes the following
 (A) Energy (B) Inertia (C) Work (D) Moment of inertia
33. The magnetic moment of a circular coil carrying current is
 (A) Directly proportional to the length of the wire in the coil
 (B) Directly proportional to the square of the length of the wire in the coil

- (C) Inversely proportional to the length of the wire in the coil
(D) Inversely proportional to the square of the length of the wire in the coil
34. Which one of these is not true for benzene?
(A) Heat of hydrogenation of benzene is less than the theoretical value
(B) There are three carbon-carbon single bonds and three carbon-carbon double bonds
(C) It forms only one type of monosubstituted product
(D) The bond angle between carbon-carbon bonds is 120°
35. Saturated vapour is compressed to half its volume without any change in temperature, then the pressure will be
(A) Doubled (B) The same
(C) Halved (D) Zero
36. In a group of 12 students the mean height measured in centimeters is 175. The mean height in meters is
(A) 1.75 meters (B) 17.5 meters (C) 0.175 meters (D) none of these
37. A cylinder rolls without slipping down an inclined plane, the number of degrees of freedom it has, is
(A) 2 (B) 5 (C) 3 (D) 1
38. Two bulbs, one of 50 watt and another of 25 watt are connected in series to the mains. The ratio of the currents through them is
(A) 2:1 (B) 1:1 (C) 1:2 (D) None of the above
39. Which of the following is a molecular crystal?
(A) Dry ice (B) Quartz (C) Rock salt (D) Diamond
40. Reason of weightlessness in a satellite is
(A) Zero gravity (B) Zero reaction force by satellite surface
(C) Centre of mass (D) None of the above
41. The gravitational force between two point masses m_1 and m_2 at separation r is given by $F = km_1m_2/r^2$. The constant k
(A) Depends on system of units only
(B) Depends on medium between masses only
(C) Depends on both (A) and (B)
(D) Is independent of both (A) and (B)
42. Mg^{2+} is isoelectronic with
(A) Ca^{2+} (B) Na^+ (C) Zn^{2+} (D) Cu^{2+}
43. One mole of which of the following has the highest entropy?
(A) liquid nitrogen (B) hydrogen gas (C) mercury (D) diamond
44. The coefficient of friction μ and the angle of friction λ are related as
(A) $\sin\lambda = \mu$ (B) $\tan\lambda = \mu$ (C) $\cos\lambda = \mu$ (D) $\tan\mu = \lambda$
45. Maximum value of static friction is called
(A) Limiting friction (B) Normal reaction
(C) Rolling friction (D) Coefficient of friction
46. A beaker containing a liquid is kept inside a big closed jar. If the air inside the jar is continuously pumped out, the pressure in the liquid near the bottom of the liquid will
(A) Increases (B) Remain constant (C) Decreases (D) First decrease and then increase
47. A large ship can float but a steel needle sinks because of
(A) Viscosity (B) Density (C) Surface tension (D) None of these

48. Maximum number of electrons in a subshell with $l = 3$ and $n = 4$ is
 (A) 10 (B) 12 (C) 14 (D) 16
49. A gas absorbs a photon of 355 nm and emits at two wavelengths. If one of the emissions is at 680 nm, the other is a
 (A) 518 nm (B) 1035 nm (C) 325 nm (D) 743 nm
50. For a symmetric distribution, the mean and median are
 (A) the same (B) different (C) sometimes same (D) none of these
51. In a class of 10 students the arithmetic mean of marks in statistics is 65. If the arithmetic mean is 72.5 for girls and 60 for boys, then the number of girls in the class is
 (A) 4 (B) 6 (C) 5 (D) 6.5
52. If the standard deviation of 10, 20, 30 and 40 is K then the standard deviation of 20, 40, 60 and 80 is
 (A) 2K (B) K-2 (C) 4k (D) k+2
53. The domain of the function $\{(3,5), (4,6), (7,8), (1,2)\}$ is
 (A) $\{3, 4, 1\}$ (B) $\{7, 1, 4\}$ (C) $\{5, 6, 7, 1\}$ (D) $\{1, 4, 7, 3\}$
54. If $\text{mod}(x-8)=10$ then the value of x is
 (A) 18 (B) -2 (C) 18 or -2 (D) None
55. The sum of the cubes of first 9 natural numbers is
 (A) 45 (B) 2025 (C) 91125 (D) 13125
56. If one root of the equation $px^2 - 14x - 8 = 0$ is six times the other then p =
 (A) 4 (B) 5 (C) 2 (D) None
57. If $A = \begin{pmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{pmatrix}$ then $A \cdot A^T =$
 (A) I (B) I^2 (C) I^3 (D) A
58. Determinant of $n \times n$ unit matrix is
 (A) 0 (B) 1 (C) 2 (D) n
59. If (7,2) and (1,6) are two vertices of a triangle and its centroid is (4,6) then the third vertex is
 (A) (4,5) (B) (4,8) (C) (4,10) (D) (3,10)
60. $\lim_{x \rightarrow 0} \frac{\sin 3x \cdot \sin 5x}{7x^2}$
 (A) 15/49 (B) 15/7 (C) 3/7 (D) 0
61. If $y = (4x + 3)^7$, then $dy/dx =$
 (A) $7(4x + 3)^6$ (B) $28(4x + 3)^7$ (C) $7(4x + 3)^6 + 4$ (D) $28(4x + 3)^6$
62. Derivative of $(x^2 \cos mx)$ with respect to x is
 (A) $-x(2 \cos mx - mx \sin mx)$ (B) $-(2 \cos mx + mx \sin mx)$
 (C) $x(2 \cos mx - mx \sin mx)$ (D) $x(2 \cos mx + mx \sin mx)$
63. Molarity of a given orthophosphoric acid solution is 3M. It's normality is
 (A) 1N (B) 2N (C) 0.9N (D) 9N

64. Which one is correct?
(A) Molality changes with temperature
(B) Molality does not change with temperature
(C) Molarity does not change with temperature
(D) Normality does not change with temperature
65. Which of the following molecules/ions does not contain unpaired electrons?
(A) O_2^{2-} (B) B_2 (C) N_2^+ (D) O_2
66. Which of the following is not correct regarding the properties of ionic compounds
(A) Ionic compounds have high melting and boiling points
(B) Their reaction velocity in aqueous medium is very high
(C) Ionic compounds in their molten and aqueous solutions do not conduct electricity
(D) They are highly soluble in polar solvents
67. Density of a crystal remains unchanged as a result of
(A) Vacancy defect (B) Interstitial defect
(C) Frankel defect (D) Schottky defect
68. The sample variance of the following sample of five numbers 1, 2, 3, 4, 5 is
(A) 2.5 (B) 9 (C) 10 (D) 13.3
69. Keeping more extreme values in a distribution, the standard deviation will
(A) reduce (B) increase (C) no affect (D) none of these
70. For a perfectly symmetrical curve, the skewness is
(A) zero (B) positive (C) negative (D) 3
71. If there is a linear relationship between the number of hours spent per week viewing TV and the students marks in the examinations, the number of hours spent by the student is the
(A) Independent variable (B) dependent variable
(C) difficult to determine (D) binary variable
72. If the dependent variable increases as independent variable increases the coefficient of correlation will be
(A) Zero (B) negative (C) positive (D) none of these
73. There is no atmosphere on the moon because
(A) it is closer to the earth
(B) it revolves round the earth
(C) it gets light from the sun
(D) the escape velocity of gas molecules is less than their root mean square velocity
74. A satellite is revolving around the sun in a circular orbit with uniform velocity v . If the gravitational force suddenly disappears, the velocity of the satellite will be
(A) zero (B) v (C) $2v$ (D) infinity
75. The dimensions of universal gravitational constant are
(A) $M^2 L^2 T^{-2}$ (B) $M^{-1} L^3 T^{-2}$ (C) $M L^{-1} T^{-2}$ (D) $M L^2 T^{-2}$

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