

ENTRANCE EXAMINATION 2016
M. Sc in Ocean and Atmospheric Sciences

Date:**Time:****Marks: 75****Instructions for the candidates:**

1. All questions carry equal marks.
2. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided on the question paper booklet.
3. The question paper consists of Objective Type questions of one mark each.
4. The question paper consists of Part 'A' and Part 'B'.
5. **There is negative marking. Each wrong answer carries - 0.33 mark.**
6. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
7. Hand over the OMR answer sheet at the end of the examination to the Invigilator.
8. No additional sheets will be provided. Rough work can be done in the question paper itself/space provided at the end of the booklet.
9. Non-programmable calculators are allowed.

PART-A

1. If $A = \begin{bmatrix} 3i & i \\ i & -i \end{bmatrix}$, then $|A| = ?$
 - a. 2
 - b. 3
 - c. 4
 - d. 5
2. A parallel plate capacitor of capacitance $100\mu\text{F}$ is connected to a power supply of 200 V. The charge on the capacitor is
 - a. 20 C
 - b. 20mC
 - c. 100C
 - d. 10000mC
3. The Boyle temperature for CO_2 gas, assuming it to be a vanderwaals gas ($a=3.59\text{l}^2 \text{atm mol}^{-2}$, $b=1 \text{mol}^{-1}$, $R=0.0821 \text{litre atm K}^{-1} \text{mol}^{-1}$) will be
 - a. 1026°C
 - b. 1026 K
 - c. 315 K
 - d. 351°C
4. If $a=3i+j-2k$ and $b=4i+5k$, then $a \times b$ will be
 - a. $5i-23j-4k$
 - b. $3i-5k$
 - c. $-2i+j+5k$

- d. $7i+j+3k$
5. Two vectors having equal magnitudes 'X' make an angle α with each other. The magnitude and direction of the resultant is
- $2A\cos(\alpha/2)$
 - $2A\sin(\alpha/2)$
 - $2A\cos\alpha$
 - $2A\sin\alpha$
6. If the boiling point of a hydrocarbon is 80°C , its critical temperature will be
- 273 K
 - 429.5 K
 - 529.5 K
 - 235.3 K
7. When $f(x)$ exists and $f'(x_0)$ is zero, then $f(x)$ is called
- Tangent point
 - Critical point
 - Maxima
 - Minima
8. A ball is thrown up at a speed of 4.0 m.s^{-1} . If acceleration due to gravity 'g' is approximately equal to 10 m.s^{-2} , the maximum height reached by the ball is
- 4 m
 - 0.80 m
 - 1.25 m
 - 2 m
9. Calculate the Sine of the angle at which second order reflection will occur in a x-ray spectrometer when x-Rays of wave length 1.54°A are diffracted by the atoms of a crystal. The interplanar distance is 4.04°A .
- 0.381
 - 0.762
 - 0.19
 - 0.88
10. If $f(x) = x \cdot \sin(x)$, then $f'(x)$ is
- 1
 - 2.1
 - $3.\infty$
 - 0
11. A screen is separated from a double slit source by 1.2 m. The distance between two slits is 0.030 mm. The second order bright fringe ($n=2$) is measured to be 4.5 cm from the centreline. The wavelength of the light would be
- 1120 nm
 - 280 nm.
 - 280 mm
 - 560 nm.
12. Arrange the following in increasing order of size: Cl^- , S^{2-} , Ca^{2+} , Ar
- $\text{Cl}^- < \text{S}^{2-} < \text{Ca}^{2+} < \text{Ar}$
 - $\text{Cl}^- < \text{S}^{2-} < \text{Ar} < \text{Ca}^{2+}$
 - $\text{Ca}^{2+} < \text{Ar} < \text{Cl}^- < \text{S}^{2-}$
 - concerning elements
13. If you multiply an inequality by a negative number, when should you reverse the inequality symbol?
- Always

- b. Never
 c. Only if the negative number is a fraction
 d. Some times.
14. Assuming that the index of refraction of water in a lake, with air above, is 1.22. What is the minimum angle at among the below at which the fish in the water has to look up towards the surface, in order to see a reflection on some object in the bottom of the pool.
- a. 40.0°C
 b. 47.8°C
 c. 60.0°C
 d. 67.8°C
15. Which one of the following statements concerning elements in the Periodic Table is correct?
- a. Elements of the same group all have the same number of electrons in the outermost occupied electron shell.
 b. Elements of Group 16 occur as cations in ionic compounds.
 c. Oxides of elements in Groups 16 and 17 are basic.
 d. The halogens (Group 17) are all gases at room temperature.
16. If the velocity of the car $V=2t^3+3t^2-t$, the acceleration for $t = 2$ will be
- a. 28
 b. 30
 c. 36
 d. 34
17. The period of a pendulum is 3s in the inertial frame of the pendulum. The period when measured by an observer moving at a speed of $0.95c$ with respect to the pendulum, where c is the constancy of the speed of light in vacuum ($c=2.99792458 \times 10^8$ m/s) would be:
- a. 9.6 s
 b. 2.85 s
 c. 2.05 s
 d. 1.5 s
18. In the Bohr's table, the following two periods have 8 and 18 elements, respectively.
- a. Sixth and fifth
 b. Second and forth
 c. Third and
 d. Fifth and seventh
19. if $y=2e^{\sin x}$, $\frac{dy}{dx}$ will be
- a. $-2e^{\sin x}$
 b. $2e^{\cos x} \cos x$
 c. $2e^{\sin x} \cos x$
 d. $2e^{\sin x} \sin x$
20. The possible orbital states for the $n=3$ levels of hydrogen are
- a. 3
 b. 9
 c. 2
 d. 4
21. One of the following statements about the Group IA elements is incorrect. Identify.
- a. These are known as Alkali metals.
 b. These are highly electronegative because of their low ionisation energies.
 c. When introduced into the flame, they give a characteristic colour to the flame.
 d. Among these, Lithium is the strongest reducing agent.
22. Which of the following vector identities is NOT correct?
- a. $i \times j = k$

- b. $k \times i = j$
 c. $j \times i = k$
 d. $i \times k = -j$
23. If a car is moving at a constant speed of 10 m.s^{-1} around a circular road of radius 50 m, its centripetal acceleration and angular speed would be, respectively
- 0.2 m.s^{-2} , and 0.2 rad.s^{-2}
 - 0.2 m.s^{-2} , and 2 rad.s^{-1}
 - 2 m.s^{-2} , and 0.2 rad.s^{-1}
 - 2 m.s^{-1} , and 0.2 rad.s^{-1}
24. Among the following, which one is the second most electronegative element of the periodic table?
- Fluorine
 - Tellurium
 - Potassium
 - Oxygen
25. The sum of k terms of geometric series with first term a , and common ratio r , where r is not equal to 1, is given by
- $\frac{a(1+r^k)}{1-r}$
 - $\frac{a(1-r^k)}{1-r}$
 - $kr-a$
 - $\frac{a+(1-r^k)}{(1-r)}$

PART-B

26. If global warming enhances, it is possible that more and more ice melts from the polar ice caps of the earth, and water will redistribute closer to the equator. In such a case, the length of the day
- will increase
 - will decrease
 - will remain constant
 - insufficient information
27. One of the following statements about Alkenes is incorrect. Identify.
- Alkenes contain two hydrogen atoms more than the corresponding alkanes.
 - Alkenes or Ethenes are also known as Olefins.
 - Characterised by presence of a double bond between two carbon atoms.
 - Alkenes react with halogen halides to form alkyl halides.
28. Which of the following cannot be a function of x
- $f(x) = \text{positive root of } \sqrt{x}$
 - $f(x) = \pm \sqrt{x}$
 - $f(x) = \text{Negative root of } \sqrt{x}$
 - $f(x) = (3x)$
29. Starting from rest, a child of mass of 20 kg takes a ride down on an irregularly curved water slide of height 2 m. The speed of the child at the bottom, assuming no friction is present, would be
- 12.52 m.s^{-1}
 - 10 m.s^{-1}
 - 6.26 m.s^{-1}
 - 9.8 m.s^{-1}

30. Helium used in the treatment of asthma owing to its quick diffusion because
- It is inert in nature.
 - It has low viscosity
 - It is a coolant
 - It is slighter than air.
31. If $y = 3^x$, then, $\frac{dy}{dx} =$
- $3^x \cdot \ln 3$
 - $x \cdot \ln 3$
 - $3^{x+1} \cdot \ln x$
 - $3^x \ln x$
32. A uniform wire of resistance 50Ω is cut into five equal parts. If these parts are now connected in parallel, the equivalent resistance of the combination is
- 10Ω
 - 250Ω
 - 2Ω
 - 6250Ω
33. How many electrons are there in the valence shell of the O^{2-} ion?
- 2
 - 8
 - 10
 - 16
34. $\int \sin^2 x \cdot \cos x \cdot dx = ?$
- $\frac{1}{2} \cos^2 x + C$
 - $\frac{1}{3} \cos^3 x + C$
 - $\frac{1}{2} \sin^2 x + C$
 - $\frac{1}{3} \sin^3 x + C$
35. In a movie shoot, a car of mass M_1 moving with a uniform velocity 'V' in a horizontal road when a stuntman, of mass M_2 , drops himself on it from the above. What will be the velocity of the car after the event?
- $\frac{M_1}{(M_1+M_2)V}$
 - $\frac{M_2}{(M_1+M_2)V}$
 - $\frac{VM_2}{(M_1+M_2)V}$
 - $\frac{VM_1}{(M_1+M_2)}$
36. Which of the following is not a colligative property?
- Lowering of vapour pressure of the solvent
 - raising the viscosity of the solvent
 - Elevating the boiling of the solvent
 - Depression in the freezing point of the solvent.
37. Identify the correct choice that decides whether or not any of following two differential equations is non-linear?
- (a) $\cos x \cdot \frac{dy}{dx} - y = x$ (b) $\frac{dy}{dx} + \sin y = 0$
- only the equation (a) is non-linear.

- b. only the equation (b) is non-linear.
 c. both (a) and (b) are not non-linear.
 d. both (a) and (b) are not linear.
38. A uniform rod of length of 1.0 m is suspended through an end, and is set into oscillation with small amplitude under gravity. The acceleration due to gravity is 9.8m.s^{-2} . The time period of oscillation is
- 0.82 s
 - 1.64 s
 - 0.95 s
 - 19.66 s
39. Given the Plank's constant as 6.6×10^{-27} erg-sec, the wave length of an electron which has a mass of 10^{-30} kg and a velocity of 6×10^5 m.s^{-1} will be
- 3.68×10^{-63} m
 - 6.6×10^{-33} m
 - 1.1×10^{-2} m
 - 1.1×10^{-9} m
40. Which of the following statements is incorrect?
- The sum of two even functions is even
 - The sum of two odd functions is odd
 - The product of two even functions is an odd function.
 - The product of two odd functions is an even function.
41. Unlike a liquid, a solid cannot easily change its shape because
- the density of a liquid is smaller than that of a solid.
 - the forces between the molecules is stronger in solids than in liquids.
 - the atoms combine to form bigger molecules in a solid.
 - the average separation between the molecules is larger in solids.
42. One of the following does not apply to the chemisorption
- Heat of adsorption is high.
 - It is highly specific
 - Adsorption is only in the upper layer.
 - It decreases with increase in temperature.
43. If $V(x,y,z)$ is an arbitrary differentiable scalar field, the $\text{curl}(\text{grad}V)$ i.e. $\nabla \times (\nabla V)$ equals
- 0
 - 1
 - $C \cdot \nabla^2 V$
 - $\nabla \cdot V$
44. If there is no external forcing acting on a non-rigid body, which of the following two quantities must remain constant?
- linear momentum, and moment of inertia
 - angular momentum, and kinetic Energy
 - angular momentum, linear momentum
 - kinetic Energy and linear momentum
45. A triple point is
- trivariant
 - univariant.
 - invariant
 - bivariant.
46. The average (arithmetic mean) of a set of five numbers is 9. When a 6th number is added to the set, the average of the six numbers is still 9. What number was added to the set?
- 5

- b. 7
c. 8
d. 9
47. The speed of light depends on
a. neither on elasticity nor inertia.
b. on elasticity of the medium only.
c. on elasticity as well as inertia.
d. on inertia of the medium only.
48. Chemical formula of Chloroform is
a. CH_2Cl_2
b. CH_3Cl
c. $\text{CH}_3\text{-CH}_2\text{-Cl}$
d. CHCl_3
49. Two papers of statistics theory and lab carries a weightage of 60% and 40% respectively. If a student scores 80% in theory and 90% in lab, what is his overall average percentage score of statistics?
a. 88%
b. 84%
c. 90%
d. 85%
50. Which of the following is an incorrect combination of a colour and a wavelength (nm) in visible range?
a. Red : 380-450
b. Orange:590-620
c. Blue: 450-500
d. Green: 500-570
51. 10 ml of solution with pH=6.0 is diluted by adding 90 ml of pure water. The new pH is
a. 6.72
b. 6.00
c. 7.60
d. 6.9
52. The mean, median, and mode are calculated for the list 8, 8, 10, 15, 17. If the number 4 is added to the list, which of the following will change?
a. mean, median, and mode
b. mean
c. mean and median
d. mean and mode
53. Which of the following remains unchanged when sound is refracted from air to water?
a. Wave number
b. Wavelength
c. Wave velocity
d. Frequency
54. Which of the following salts will turn lime water milky, when heated?
a. Nitrate
b. Sulphate
c. Oxalate
d. Chloride
55. Why it is necessary to square the differences from the mean when computing the population variance?
a. Take care of extreme values

- b. some differences will be positive and some will be negative
 - c. possible population is small
 - d. none of these
56. A positively charged particle projected towards east is deflected by a magnetic field towards north. The field may be
- a. towards west
 - b. towards south
 - c. downward.
 - d. Upward
57. Which of the following is an oxidation reaction?
- a. Ionization of Na.
 - b. Dissolution of NaCl in water.
 - c. Heating of CaCO_3 to liberate CO_2 .
 - d. Negative ion formation of Re.
58. The average score for a statistics test is 85 and the standard deviation is 4. Which percent best represents the probability that any one student scored between 77 and 93 on the test?
- a. 99.55
 - b. 95%
 - c. 68%
 - d. 50%
59. A moving charge produces
- a. both electric and magnetic fields
 - b. only magnetic field
 - c. neither electric nor magnetic fields
 - d. Only electric field
60. When a salt is added to the water
- a. its boiling point decreases
 - b. its freezing point increases
 - c. its vapour pressure increases
 - d. Its vapour pressure decreases
61. When a distribution is symmetrical and has single mode, the highest point of the curve is called the
- a. Mode
 - b. Median
 - c. Mean
 - d. All of these
62. A raft is made of wood with a density of 600 kg.m^{-3} . Its surface area is 5.7 m^2 , and its volume 0.60 m^3 . If the raft would be placed in fresh water of density $1,000 \text{ kg.m}^{-3}$, to what depth would the raft sink in the water?
- a. 0.060 m
 - b. 3.5 m
 - c. 0.006 m
 - d. 0.35 m
63. Photosynthesis converts solar energy to
- a. mechanical energy
 - b. chemical energy
 - c. potential energy
 - d. kinetic energy
64. What is the probability that a value chosen at random from a population, is larger than the median of the population?

- a. 1.0
b. 0.25
c. 0.50
d. 0.0
65. A pan of water is heated from 25°C to 80°C. The *change* in temperature on the Kelvin and the Fahrenheit scales can be expressed as
- a. 80 K, 55 °F
b. 99 K, 55°F
c. 55 K, 99°F
d. 99 K, 99°F
66. Transition metals
- a. exhibit variable oxidation states
b. have low melting point
c. exert inert pair effect
d. do not show catalytic activity
67. The correlation coefficient between x and y is 0.60. What is the correlation coefficient between y and x?
- a. -0.60
b. 1.66
c. 0.60
d. 0.06
68. The highest theoretical efficiency of a gasoline engine, based on the Carnot cycle, is 30%. If this engine expels gases in to the atmosphere, which has a temperature of 300 K, what is the temperature in the cylinder immediately after combustion?
- a. 210 K
b. 273 K
c. 300 K
d. 430 K
69. Which of the following reaction is exothermic?
- a. $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
b. $\text{NaCl} \rightarrow \text{Na}^+ + \text{Cl}^-$
c. $\text{H}_2 + \frac{1}{2} \text{O}_2 \rightarrow \text{H}_2\text{O}$
d. $2\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
70. Suppose *a* is 5 and *b* is 10 for an estimated line $y = a + bx$. If the independent variable has a value 10, what value should be expected for dependent variable?
- a. 105
b. 60
c. 0.5
d. 15
71. The saturation current in a triode valve can be changed by changing
- a. the grid voltage.
b. the plate voltage.
c. the separation between the grid and cathode.
d. the temperature of the cathode.
72. Ozone absorbs strongly in the
- a. Infrared
b. Ultraviolet
c. visible
d. microwave

73. For a normal curve with $\mu=65$ and $\sigma=10$, how much area will be found under the curve to the left of the value 65?
- 0.25
 - 0.5
 - 1.5
 - 1.0
74. Electric conduction in a semiconductor takes place due to
- electrons only.
 - holes only.
 - neither electrons nor holes
 - both electrons and holes
75. When two gases are mixed at the same temperature and pressure, the entropy increases because of
- energy exchange
 - thermal exchange
 - volume change
 - increase in the average kinetic energies