

Hall Ticket No: 

University of Hyderabad  
ENTRANCE EXAMINATION 2012  
M. Sc in Ocean & Atmospheric Sciences

Date: 04.06.2012

Time: 2.00 pm

Marks: 75

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**Instructions for the candidates:**

1. All questions carry equal marks.
  2. Write your Hall Ticket Number on the OMR Answer Sheet and in the space provided on the question paper.
  3. The question paper consists of Objective Type questions of one mark each. For each question, there are four answers and the answers are to be indicated with capital letters of alphabets viz., A, B, C and D.
  4. The question paper consists of Part 'A' and Part 'B'.
  5. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
  6. Hand over both the question paper booklet and the OMR answer sheet at the end of the examination.
  7. No additional sheets will be provided. Rough work can be done in the space provided at the end of the booklet.
  8. Non-programmable calculators are allowed.
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PART - A

1. The mean free path of air molecules in the Earth's atmosphere
  - A. Stays constant with both altitude and latitude.
  - B. Stays constant only with altitude.
  - C. Increases with altitude.
  - D. Decreases with altitude.
2. The escape velocity of oxygen molecule in the Earth's atmosphere is  $\sim 11 \text{ km s}^{-1}$ . That on nitrogen molecule would therefore be:
  - A.  $\sim 11 \text{ km s}^{-1}$ .
  - B.  $\sim (77/8) \text{ km s}^{-1}$ .
  - C.  $\sim (88/7) \text{ km s}^{-1}$ .
  - D.  $\sim 10 \text{ km s}^{-1}$ .
3. The World population was  $\sim 1.5$  billion in 1900 CE, while it was 6 billion in 2000 CE. What is the mean percentage of growth per decade?
  - A. 14.87
  - B. 20
  - C. 2
  - D. 13.95
4. Solar constant is roughly  $\sim 2 \text{ cal/cm}^2/\text{min}$ . What is its value in  $\text{Wm}^{-2}$ ?
  - A. 33.3
  - B. 1400
  - C. 1000
  - D. 280

4-15

5. Which of these atmospheric gases has been increasing steadily since 1900 CE?
  - A.  $N^2$
  - B.  $O^2$
  - C.  $H_2O$
  - D.  $CO_2$
6. Given that photosynthetic activity of plants mainly controls the atmospheric  $CO_2$  oscillations, when is it expected to be a minimum?
  - A. End of summer
  - B. End of winter
  - C. End of fall
  - D. End of spring
7. Greenhouse gases absorb outgoing longwave radiation from the Earth. This radiation has a wavelength of (in  $\mu m$ ):
  - A. 0.001
  - B. 0.01
  - C. 0.1
  - D. 10
8. Winter in Antarctica is
  - A. Throughout the year
  - B. During December to February
  - C. During June to August
  - D. During September to November
9. If easterlies are the winds blowing from the east, what are westerlies?
  - A. Winds blowing from the east, but going towards the west
  - B. Winds blowing from the west but only in the southern hemisphere
  - C. Winds blowing from the west in any hemisphere
  - D. Winds blowing from the west but only in the northern Hemisphere
10. For measuring the temperature of the surface of the Sun, we must use
  - A. A mercury thermometer
  - B. A platinum resistance thermometer
  - C. A bolometer
  - D. A radiotelescope
11. The maximum water vapour content in 1 kg of air could be roughly
  - A. 1 mole
  - B. 1 milli mole
  - C. 1 micro mole
  - D. 10 moles
12. Cloud are usually made of
  - A. Water vapour only
  - B. Water vapour and liquid water drops only
  - C. Water vapour, liquid water droplets and some ice crystals
  - D. Water vapour and carbon dioxide only

13. The maximum amount of evaporation from the oceans are from the latitude belt:
- A. 20°N to 20°S
  - B. 30°N to 50°N
  - C. 30°S to 50°S
  - D. 70°S to 90°S
14. The resistance of a platinum wire
- A. Increases with temperature
  - B. Decreases with temperature
  - C. Does not change with temperature
  - D. Stays constant only at high temperature.
15. An aerosol particle with radioactive element of half life 10 s was collected at 2.00 pm. What fraction of the original amount of the element would be present in the particle at 2.30 pm?
- A.  $\frac{1}{3}$
  - B.  $\frac{1}{2}$
  - C.  $\frac{1}{4}$
  - D.  $\frac{1}{8}$
16. The coldest city in the world is
- A. Colombo
  - B. Singapore
  - C. Toronto
  - D. Vladivostok
17. The highest rainfall in the world is received at
- A. Cherrapunji or Mahsinram
  - B. Antarctica
  - C. Mumbai
  - D. Greenland
18. Which gas is the major component of dissolved gases in the ocean water?
- A. Oxygen
  - B. Nitrogen
  - C. Argon
  - D. Methane
19. It is difficult to cook lentils at high altitudes because
- A. Lentils do not soak well in water at lower temperatures
  - B. Lentils do not soak well in water at lower pressures
  - C. Water boils at a low temperature
  - D. Water boils at a higher temperature
20. Pick out the **WRONG** answer: Compared to fresh water, sea water
- A. Boils at a higher temperature
  - B. Is more conductive
  - C. Has a higher density
  - D. Freezes at a higher temperature

- 21. The Coriolis force deflects winds
  - A. To the right in the Southern Hemisphere
  - B. To the left in the Northern Hemisphere
  - C. To the left in both Hemispheres
  - D. To the right in the Northern Hemisphere
- 22. The solutions of the equation  $x^2 - 5x + 5 = e^{ix}$  are
  - A. Both Imaginary
  - B. Both real
  - C. one imaginary and one real
  - D. both complex
- 23. The sum of the infinite series  $1-1+1-1+1-1+1-1\dots$  is
  - A. 0
  - B. 1
  - C. 0.5
  - D. Infinite
- 24. A ball is picked at random from a bag containing 50 white balls and is put back. Another 50 white balls are added to the bag. By doing so we have, in another draw,
  - A. Increased the probability of picking a white ball slightly
  - B. Decreased the probability of picking a white ball
  - C. Not affected the probability of picking a white ball
  - D. Doubled the probability of picking a white ball
- 25. Which of the following is a solution of  $d^2y/dx^2 + k^2y = 0$ ? ( C, D, c and d are arbitrary constants).
  - A.  $C \sin kx + d$
  - B.  $D \cos kx + C$
  - C.  $C \sin kx + d \cos kx$
  - D.  $-k^2x^3/6 + cx + d$

PART - B

- 26. The value of the determinant  $\begin{vmatrix} 1 & 2 & 1 \\ 2 & 4 & 3 \\ 3 & 6 & x \end{vmatrix}$  where x is unknown, is
  - A. indeterminate
  - B. zero
  - C.  $2(4x-18)$
  - D.  $22 + x$

- 27. Altimeter is used for measuring
  - A. sea level
  - B. sea surface temperature
  - C. sea surface salinity
  - D. ocean colour
- 28. The most abundant element in the earth is
  - A. Oxygen
  - B. Magnesium
  - C. Iron
  - D. Silicon

- 29. By what factor would the brightness of a star decrease if an observer moved from 1 to 3 light years from the star?
  - A. 3 times
  - B. 9 times
  - C. 27 times
  - D. 81 times
  
- 30. The most important gas responsible for the greenhouse effect is
  - A. Carbon dioxide
  - B. Methane
  - C. Water vapor
  - D. Nitrous oxide
  
- 31. The annual range of temperature over Siberia (located in the northern part of Asia in Russia) is larger than that at Mumbai because
  - A. It is not a developing country
  - B. Of Greenhouse effect
  - C. It is at a higher latitude
  - D. It is a larger area
  
- 32. Without the greenhouse effect, the surface temperature of the earth would be lower by
  - A. 18°C.
  - B. 15°C.
  - C. 30°C.
  - D. 255K.
  
- 33. The hydrological cycle describes the transport of
  - A. Nitrogen
  - B. Carbon
  - C. Water
  - D. Hydrogen
  
- 34. The region of the ocean where temperature decreases rapidly with depth is called the
  - A. Thermocline
  - B. Pycnocline
  - C. Isoline
  - D. Incline
  
- 35. Cooling sea-water results in its sinking because
  - A. It increases the buoyancy
  - B. It increases the salinity
  - C. It decreases the entropy
  - D. It increases the density
  
- 36. The geostrophic approximation is a balance between
  - A. Coriolis and hydrostatic forces
  - B. Coriolis and pressure gradient forces
  - C. Frictional and hydrostatic forces
  - D. Frictional and pressure gradient forces

37. The El Niño impacts the Indian summer monsoon through
- Teleconnections
  - Telekinesis
  - Viscous effects
  - Dipole effect
38. The glacial-interglacial cycles due to orbital variations are also known as
- Carnot cycles
  - Rabinowitz cycles
  - Milankovich cycles
  - Solar cycles
39. Most tropical cyclones originate \_\_\_\_\_.
- Between  $0^\circ$  and  $5^\circ$  north and south of the equator
  - In the centers of sub-tropical highs
  - Between  $10^\circ$  and  $20^\circ$  north and south of equator
  - To the west of westerly winds
40. The concentration of nitrogen in the Earth's atmosphere at sea level is about
- 4%
  - 21%
  - 78%
  - 96%
41. The \_\_\_\_\_ of the earth's atmosphere shields the earth from harmful ultraviolet radiation.
- Equatorial bulge
  - Ionic layer
  - Ozone layer
  - Protective layer
42. The layer of the earth that reflects radio waves back to the earth is called the
- Ionosphere
  - Radiation zone
  - Aurora borealis
  - Ozone layer
43. The phenomenon of polar lights (aurora) commonly occurs in the
- Stratosphere
  - Ionosphere
  - Troposphere
  - Mesosphere
44. The atmospheric pressure at mean sea level is
- $1.03 \text{ kg/cm}^2$
  - $10.3 \text{ kg/cm}^2$
  - $14.7 \text{ kg/cm}^2$
  - $.017 \text{ kg/cm}^2$

45. The temperature is minimum
- Just after sunset
  - Around midnight
  - About 2:00 to 3:00 am
  - Just before sunrise
46. The portion of the atmosphere which extends from the earth's surface up to 15 km and experiences decrease in temperature at constant rate is the
- Stratosphere
  - Tropopause
  - Troposphere
  - Mesosphere
47. A northerly wind means a \_\_\_\_\_.
- Wind coming from the north
  - Wind going towards the north
  - Wind in the northern hemisphere
  - Wind in northern India
48. An empirical measure for describing wind speed based mainly on observed sea conditions is called the
- Beaufort scale
  - Richter scale
  - Fujita scale
  - Storm scale
49. Isohyet is a line joining points having
- The same atmospheric pressure
  - The same amount of rainfall
  - The same temperature
  - The same depth of water table
50. Relative to the horizon, as seen from the earth's southern hemisphere, the sun daily
- Rises in the east and sets in the west.
  - Rises in the west and sets in the east.
  - Moves mainly in a northward direction.
  - Moves mainly in a southward direction.
51. When Venus has reached its maximum eastern elongation from the sun as viewed from the earth, it is visible in the sky
- In opposition to the sun.
  - As an evening "star".
  - As a morning "star".
  - In conjunction with the sun.
52. In order to have a solar eclipse, you need to have
- A full moon.
  - A new moon.
  - The moon on or close to the ecliptic.
  - (B) and (C)

53. From where on the Earth will we see the North Star at the horizon?
- North pole
  - South pole
  - on the Equator
  - Nowhere-- it is not possible.
54. According to Kepler's Law, the cube of the mean distance of a planet from the Sun is proportional to the
- Area that is swept out in one period
  - Cube of its period
  - Square of its period
  - square-root of its period
55. In our solar system which planet has a moon with a mass closest to its own?
- Earth
  - Mars
  - Jupiter
  - Saturn
56. Which of the following devices would not work on the Moon?
- Thermometer
  - Spectrometer
  - Spring balance
  - Siphon
57. Which planet can't be seen high in the sky at midnight?
- Venus
  - Mars
  - Jupiter
  - Saturn
58. What is the essential difference between X-ray, radio waves and infrared radiation?
- wave amplitude
  - temperature
  - wavelength
  - wave velocity
59. The apparent daily path of the Sun in the sky during winter is different from that in summer, because
- the sun revolves
  - Earth's distance from the Sun changes
  - the Sun rotates
  - Earth's axis is tilted
60. The following instrument demonstrates the rotation of the Earth around its axis.
- pendulum clock
  - Foucault's pendulum
  - spectrometer
  - photomultiplier tube



61. If you were to stand on the Moon, then the position of the Earth in the moon sky
- A. will remain the same with time
  - B. will change with time
  - C. will not be able to see the Earth from the Moon
  - D. none of the above
62. Semi-diurnal tides have
- A. one high and one low daily
  - B. two highs and one low daily
  - C. one high and two lows daily
  - D. two highs and two lows daily
63. The evaporation through plants and from the surrounding soil together is known as
- A. Transpiration
  - B. Evaporation
  - C. Evapo-transpiration
  - D. Both a and b
64. We see the same face of the Moon always, because
- A. The Moon does not rotate on its axis
  - B. The phases of the Moon make it appear so.
  - C. The rotation period of the Moon is the same as the period of revolution of Moon around the Earth
  - D. Magnetic forces due to material on Earth and Moon keep them locked in the same orientation
65. The amount of salt present in 1 kg of sea water is:
- A. 3.5g
  - B. 35mg
  - C. 35g
  - D. 350mg
66. Thermocline is the depth-region of the ocean where
- A. Temperature increases rapidly with depth
  - B. Temperature decreases rapidly with depth
  - C. Temperature remains uniform
  - D. Temperature is the lowest
67. Because of the Coriolis force, a southward ocean current in the southern hemisphere deflects
- A. westward
  - B. eastward
  - C. downward
  - D. not affected

68. Sinking motion in the thermohaline circulation takes place
- A. along the the Gulf Stream
  - B. near the equator
  - C. near polar regions
  - D. off the coast of Peru
69. Which of the following is least expected in a desert?
- A. Playa
  - B. Rounded hills
  - C. Gorges
  - D. Wide stream channels
70. Monsoon winds
- A. always blow from the same direction
  - B. change direction twice a year
  - C. change direction thrice a year
  - D. change direction once a year
71. Arrange the cities in the order of increasing rainfall  
(1) Mangalore (2) Mumbai (3) Cherrapunji (4) Jaipur
- A. 1-2-3-4
  - B. 4-2-1-3
  - C. 4-1-2-3
  - D. 4-3-2-1
72. Period of a solar cycle is typically
- A. 11 years
  - B. 110 years
  - C. 60 years
  - D. 30 years
73. Pick out the odd one:
- A. Coulomb's law
  - B. Newton's law of Universal gravitation
  - C. Law regarding change in the intensity of light with distance from the source
  - D. Beer-Lambert's law
74. When a foot ball bladder is pumped with air, it expands.
- A. Pressure and volume both increase at constant temperature
  - B. Pressure, temperature and volume, all increase
  - C. Pressure increase and volume decreases
  - D. volume increases and pressure decreases
75. Identify the correct statement.
- A. One mole of liquid water is heavier than one mole of air
  - B. One mole of water vapour is heavier than one mole of air
  - C. One mole of water (liquid or vapour) is always lighter than one mole of air
  - D. One mole of water will be either heavier or lighter than air, depending on the temperature