



Geological Society of India



EARTH SCIENCE OLYMPIAD –National level Entrance Test Maximum marks 100

Date: January 21, Sunday 2018 Time: 10.30 a.m. to 12.00 noon

INSTRUCTIONS

1. You need to be present in the examination hall well before the commencement of the test.
2. You will not be permitted to enter the examination hall 30 minutes after the commencement of the test.
3. You will not be permitted to leave the examination hall until after 30 minutes of commencement of the test.
4. If you have any paper/chit with you, surrender them to the invigilator now.
5. All are multiple-choice questions.
6. Please use a BLACK/BLUE ball point pen to mark your answers. DO NOT use pencil.
7. This sheet should not be folded or crushed
8. Choose the MOST appropriate answer.
9. Darken the circle corresponding to the answer of your choice.

10. Do not use stray marks on the **Answer sheet**

Answer the question for Example

Question

The shape of A B C D

the Earth is

- (a) Spherical ☐ ☒ ☐ ☐
- (b) Spheroidal ☐ ☒ ☐ ☐
- (c) Ovoid ☐ ☒ ☐ ☐
- (d) Ellipsoidal ☐ ☒ ☐ ☐

- Marks will not be awarded if more than one answer is chosen.

- Your answer must be given only in the answer sheet (overleaf) and handover the original answer sheet to the invigilator

11. Please enter your Registration No. and affix your signature on the answer sheet before starting to answer the questions.

12. **The answer keys will be published in Geological Society's Web site:**

<http://www.geosocindia.org/index.php/ieso> on 24th January 2018

Dear Student

We appreciate your interest in the International Earth Science Olympiad. Please spend a minute to let us know how you learnt about the IESO-Entrance Test (can choose more than one option).

☐ *From my school / college*

☐ *IESO Poster*

☐ *From a friend*

☐ *From Geological Society's Web site*

☐ *From any other source, specify*

Please send your comments on the question paper within a week by email (hachyuthan@yahoo.com) with copy endorsed to gsocind@gmail.com, or by regular mail to:

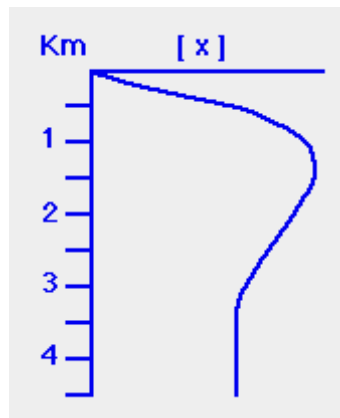
Dr. Hema Achyuthan, IESO National Co-ordinator, Institute for Ocean Management, Anna University, Chennai – 600 025.

National Level Entrance Test (21st January 2018, Sunday) Earth Science Olympiad
Sunday the 21st January 2018 Time: 10.30 a.m. to 12.00 Noon.
All questions carry equal marks. Maximum marks 100

Answer all the questions

1. Echo sounding is used to estimate –
 - a) atmospheric pressure
 - b) ocean depth
 - c) ocean temperature
 - d) atmospheric temperature
2. El-Nino is related to -
 - a) unusual warming of Peru-Chile coast during December
 - b) unusually high rainfall during monsoon
 - c) earthquake in the Pacific
 - d) hurricanes in the Atlantic
3. During El-Nino period, thermocline depth deepens over the
 - a) Western equatorial Pacific
 - b) Eastern equatorial Pacific
 - c) Southern Pacific
 - d) North Pacific
4. Bioavailable nitrogen (such as nitrate) is lost from the ocean through
 - a) nitrification
 - b) denitrification
 - c) nitrogen fixation
 - d) ammonification
5. Age of the earth can be determined by the radioactive element that has a half-life of the order of
 - a) thousand years
 - b) ten thousand years
 - c) million years
 - d) billion years
6. In ocean, respiration exceeds over primary production
 - a) in the euphotic depth
 - b) below euphotic depth
 - c) in the mixed layer
 - d) above thermocline

7. Following profile in the ocean belongs to....., which is



- a) Conservative b) Scavenged c) Nutrient d) mixed type

8. Carbon: Nitrogen: Phosphorus in the deeper ocean is

- a) 100:10:1
b) 10:100:1
c) 16:106:1
d) 106:16:1

9. High Nutrient Low Chlorophyll regions are located in the

- a) equatorial oceans b) tropical oceans
b) sub-tropical oceans d) polar oceans

10. To change pH of a solution from 10 to 8, how many times do you expect a change in $[H^+]$:

- a) 1000 b) 100 c) 10 d) 1

11. Green House gases:

- a) trap sun's heat
b) trap the heat released from the earth's surface
c) decrease earth's temperature
d) are not produced by burning of fossil fuels

12. Which of the following reactions is the best representative of photosynthesis:

- a) $CH_2O + O_2 \rightarrow CO_2 + H_2O$
b) $2C + 3H_2 \rightarrow C_2H_6$
c) $H_2 + \frac{1}{2} O_2 \rightarrow H_2O$
d) $CO_2 + H_2O \rightarrow CH_2O + O_2$

13. Atmospheric pressure at sea level is:

- a) 0.03 kg cm^{-2} b) 1.03 kg cm^{-2} c) 2.3 kg cm^{-2} d) 10.3 kg cm^{-2}

14. Most critical aspect among the essential ones for the ocean circulation to be

constantly functional is

- a) formation of horizontal pressure gradients
- b) formation of vertical pressure gradients
- c) formation of deep water masses
- d) formation of density gradients

15. During evaporation, water experiences

- a) specific heat loss
- b) latent heat loss
- c) specific heat gain
- d) latent heat gain

16. In general, the ocean does not respond to the seasonally changing insolation as strongly as the atmosphere. However, there is a region where the ocean circulation changes dramatically every year between summer and winter. Where and why?

- a) In the northern Indian Ocean due to changing wind patterns (monsoons) causing a reversal of currents
- b) In the Pacific, due to the changing wind patterns caused by the so-called El Niño events.
- c) In the Antarctic, where winds change direction completely which becomes visible through reversal of the circumpolar current.
- d) In the wind-driven ocean gyres where plastic accumulates every summer when the gyres spin up, and where the plastic is released when the gyres slow down.

17. Which of the following is not a greenhouse gas:

- a) N_2
- b) CO_2
- c) N_2O
- d) CH_4

18. What is the average depth of the oceans:

- a) 35 m
- b) 350 m
- c) 3500 m
- d) 35000 m

19. Pure water reaches its maximum density at:

- a) 50°F
- b) 0°C
- c) 32°F
- d) 4°C

20. Which process increases the salinity of surface sea water:
- a) Rainfall
 - b) Riverine flux
 - c) sea-ice formation
 - d) upwelling
21. A windy day is an example of
- a) weather
 - b) climate
 - c) both
 - d) none of these
22. Collectively, the suspended, single-celled, photosynthesizing microorganisms in the world ocean are called:
- a) zooplankton
 - b) virioplankton
 - c) phytoplankton
 - d) jellyplankton
23. Which of the following geological processes is not related to the convergent plate boundary?
- a) Building of new ocean floor
 - b) Explosive volcanism
 - c) Mountain building
 - d) Thrust faulting
24. Which of the following has the longest chain of volcanoes on the Present globe?
- a) Indonesian islands
 - b) Japanese islands
 - c) Hawaiian Islands
 - d) Mid Oceanic Ridges
25. Fracture zones on the Present globe are generally
- a) Transverse to the Mid Oceanic Ridge segments
 - b) Parallel to the Mid Oceanic Ridge segments
 - c) within the median valley of the Mid Oceanic Ridges
 - d) along the hot-spot tracks
26. Choose a pair of minerals which represents aluminosilicates
- a) Muscovite -Biotite
 - b) Kyanite-Sillimanite
 - c) Apatite-Chlorite
 - d) Tremolite-Actinolite
27. Which one of the following is a difference between a transform fault and a transcurrent fault?
- a) A transcurrent fault is a strike-slip fault but the transform fault is a thrust fault
 - b) transform fault is a strike-slip fault but the transcurrent fault is a normal fault

- c) transform fault is limited between the plate boundaries but the transcurrent fault continues beyond the plate boundary
- d) transform fault is limited to ocean floor but the transcurrent fault is limited to continental crust.

28. Which of the following is Not true for the early period of Earth

- a) There was no free oxygen in the atmosphere b) There were frequent meteorite impacts
- c) More heat was being produced from the radioactive elements compared to present
- d) Continental crust occupied larger surface area than present

29. What are the three components of the stream power equation

- a) Stream discharge, river width and river depth
- b) Hydraulic radius, channel slope and dissolved oxygen levels
- c) Stream discharge, channel slope and water density
- d) Channel slope, river width and mean annual precipitation

30. An example of a white mica is

- a) Phlogopite b) Biotite c) Muscovite d) Chlorite

31. A lithospheric fragment on being stretched may develop a rift. The rifting would be accompanied by

- a) normal faulting b) thrust faulting c) strike-slip faulting d) thrust and strike slip faulting both

32. If a fragment of oceanic lithosphere is found on a continent, that would be called

- a) Kimberlite b) Ophiolite c) Mylonite d) Hot-spot

33. What is the name of the process in which small particles become trapped by larger particles in the bedload so that they cannot be entrained even though flow is great enough?

- a) Floodplain aggradation b) Hellicoidal flow c) Particle Imbrication d) Rock cohesion

34. Mean water velocity in an open channel is estimated using which of the following?

- a) Manning's equation b) Hjulström curve c) Water balance curve d) Reynolds number

35. A set of parallel planes, defined by alignment of minerals, produced during metamorphism in the regionally metamorphosed rocks are called

- a) Faults b) Joints c) Bedding d) Foliation

36. Surface of the moon has numerous craters that are created due to the heavy bombardment. We don't have so many craters on Earth, because

- a) Earth did not experience heavy bombardment (b) Surface of the Earth has been under continuous modification due to geological processes (c) Craters on Earth are in oceans (d) Bombardment on Earth was by lighter objects that could not form craters.

37. A portion of the mantle undergoes partial melting. The ratio of an incompatible to a compatible element in the resultant melt would be

- a) same as that in the residual solid mantle b) higher than the residual solid mantle c) lower than the residual solid mantle d) depends on the isotope of the elements involved

38. Zircon grains are generally dated by U-Pb dating method and not by Rb-Sr dating method, because

- a) The initial U/Pb ratio in the zircon is much lower compared to the initial Rb/Sr ratio, making it easier to measure the increase in U/Pb ratio due to radioactive decay of U. b) U is radioactive decaying to Pb but Rb and Sr both are not radioactive c) The initial U/Pb ratio in the zircon is very high making it easier to measure the radiogenic Pb d) The Rb-Sr system has lower half life than the U-Pb system

39. Which of the following is not a Garnet?

- a) Almandine b) Pyrope c) Grossular d) Cordierite

40. A gabbroic rock is observed within the layers of shale which overlies a limestone. The limestone is cut by a dolerite dyke which is not found continuing into the shale. Which of the following statement is true?

- a) limestone is chemically precipitated simultaneous to an underwater volcanic eruption that emplaced dolerite dyke b) Limestone is the oldest rock of the three while the gabbroic rock is a sill within shale. c) dolerite dyke is the youngest while the limestone is the oldest rock. d) The shale is the youngest rock while the dolerite dyke, the gabbroic rock and the limestone all formed simultaneously.

41. Which of the following marks the eastern boundary of the India plate?
a) Eastern Ghats b) Coromondal coast c) Indo-Myanmar Range d) Karakoram fault
42. Which of the following observations helped understand the continental drift hypothesis?
a) regular arrangements of paleomagnetic anomalies on sea-floor b) rugged topography of the sea-floor c) volcanism within the sea-floor d) presence of serpentinites on continents
43. Which of the following is NOT a supercontinent?
a) Purana b) Rodinia c) Gondwana d) Pangea
44. The mantle convection takes place because of
a) plate-movements b) rotation of earth c) temperature and density differences
d) heterogeneous distribution of mass within the continental crust
45. If a radioactive nuclide decays by β^- decay the resultant daughter would have
a) same mass number but different atomic number b) same atomic number but different mass number c) same mass number and same atomic number
d) different mass number and different atomic number
46. The difference between the temperature variation in crust and mantle is that temperature
a) increases with a faster rate in the crust but with a slower adiabatic rate in the mantle
b) increases with slower adiabatic rate in the crust but with a faster rate in the mantle
c) remains constant in the crust but decreases in the mantle
d) decreases in the crust but increases in the mantle.
47. Magma originated by partial melting inside the Earth would
a) crystallize completely after some time at the same depth of origin
b) start rising up due to buoyancy c) assimilate the country rock and become a larger magma chamber at the depth of origin d) would sink deeper to add to the liquid core.

48. A transform fault connecting an overriding plate margin with another overriding plate margin, would

- a) decrease in length with time b) increase in length with time
- c) not change in length with time d) become a transcurrent fault with time.

49. According to the plate-tectonic theory

a) Continents drift relative to each other but oceans remain fixed b) Sea floor spreading takes place but no movement occurs in continents c) Plates consisting of oceans and/or continents move relative to each other d) Crust floats over a liquid mantle.

50. Which of the following is generally not a part of oceanic crust?

- a) Sedimentary rocks b) basaltic lavas c) gabbro d) granite

51. Quartz crystallises in which system

- a) Cubic b) Tetragonal c) Hexagonal d) Orthorhombic

52. Rocks on a rapidly subducting plate are likely to experience which of the following metamorphic facies conditions first, if they are taken to depth away from arc magmatism?

- a) Amphibolite b) Granulite c) hornblende hornfels d) Blueschist

53. The arcuate shape of Island arcs is a consequence of

- a) wedge shaped mantle below b) subduction in a spherical surface c) plate movement over a fixed hot spot d) zigzag plate margins

54. Some folded rock-layers are found cropping out on the surface. It means

- a) These rocks were subjected to stresses under high pressure, temperature conditions
- b) these rocks are made up of foldable material at surface temperature conditions
- c) These rocks are folded during the thrust faulting that exposed them on the surface
- d) These are not silicate rocks.

55. The velocity of seismic waves increases at the depth of 670 km in the mantle, this is because of

- a) change in crystal structure from spinel to perovskite type

b) presence of heavy Fe-Ni material c) refraction of waves from the lower-mantle boundary d) core-mantle boundary.

56. Olivine is generally the first mineral to crystallize from a basaltic melt. Which of the following elements would get more depleted in the residual melt due to the olivine crystallization?

a) Al b) K c) Na d) Mg

57. A 2 billion year old zircon is discovered from a sedimentary rock which was deposited at 550 million year back. This means

a) The zircon was the first mineral to get deposited and the deposition process continued from 2 billion year ago to 550 million year ago. b) the primary source rock of the zircon must have formed 2 billion year ago c) The zircon was buried deep inside the Earth from 2 billion year ago to 550 million year ago d) there was no geological activity from 2 billion year ago to the 550 million year ago.

58. Sr gets incorporated more easily in plagioclase mineral compared to in the biotite, because

a) plagioclase has higher melting point than the biotite b) plagioclase has larger stability range in terms of pressure and temperature compared to the biotite c) Ca in plagioclase is similar in size and charge to the Sr and therefore get replaced by it easily d) silica tetrahedral makes a framework structure in plagioclase providing larger space for Sr compared to the sheet structure in biotite.

59. Which of the following is an ore mineral of uranium?

a) Zircon b) Pitchblende c) Magnetite d) Apatite

60. Which of the following samples would be most suited for Carbon-dating?

a) Quartz tool from an archaeological site
b) A bone sample from an Harappan archaeological site
c) A sample of lignite from Miocene coal beds
d) A sample of coal from Gondwana coal beds.

61. A suture zone is a
- a) trace of thrust fault along a convergent plate boundary
 - b) axis of median rift valley along a divergent plate boundary
 - c) line of ocean closure at a convergent plate boundary
 - d) zone of thrusting along a convergent plate boundary.
62. Which rocks find application in the manufacture of fertilizers
- a) Sandstone
 - b) Phosphorites
 - c) Granites
 - d) Marbles
63. Mercury rises before Sun when
- a) it is at greatest western elongation
 - b) it is at greatest eastern elongation
 - c) when it makes an angle of 180° at earth
 - d) None of these
64. Indian standard time is different from the Greenwich meantime because of
- a. Longitude difference
 - b. Latitude difference
 - c. Rotation of earth
 - d. None of the above
65. Which of the following is a result of direct interaction between lithosphere-atmosphere-hydrosphere and biosphere
- a. Movement of plates
 - b. Volcanic eruption
 - c. Formation of soil
 - d. Recharge of underground aquifer
66. Acceleration due to Earth's gravity at the center of earth is
- a) 0.0 km/s^2
 - b) 9.8 km/s^2
 - c) 11.2 km/s^2
 - d) 6400 km/s^2
67. Pointer in the magnetic compass is directed towards
- a) geographic north
 - b) geomagnetic north
 - c) both
 - d) none
68. The Coriolis force is a force and its direction in the northern hemisphere is,
- a) pseudo, clockwise
 - b) pseudo, anticlockwise
 - c) real, clockwise
 - d) real, anticlockwise
69. At quadrature the elongation of the planet is,
- a) perpendicular to the sun
 - b) 180°
 - c) 0°
 - d) none of these

70. To facilitate a satellite in an elliptical orbit to move farther from earth, which of the following technique is useful?

- a) increasing the velocity at perigee
- b) decreasing the velocity at perigee
- c) increasing the velocity at apogee
- d) decreasing the velocity at apogee

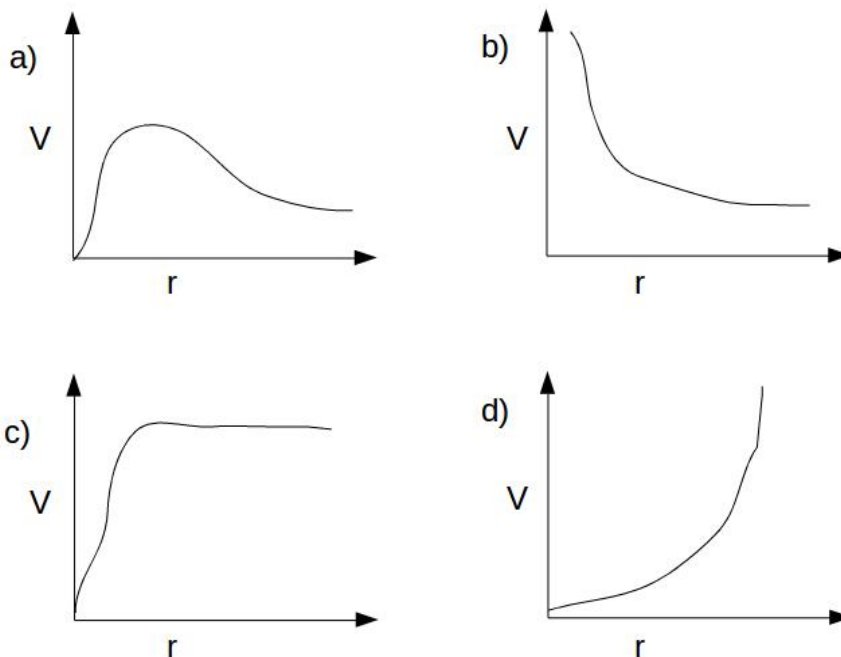
71. What is the ratio of the angle covered by earth in its orbit around sun in one month at perigee and apogee (15 days on both sides of apogee and perigee point)? Given that the Aphelion to perihelion distance ratio is 1.034.

- a) 0.923
- b) 0.935
- c) 0.911
- d) 0.900

72. Calculate the energy of the H_α (Balmer) photon (Rydberg constant R_∞ is $1.0973731568508 \times 10^7$ per metre).

- a) 1.89 eV
- b) 2.56 eV
- c) 3.03 eV
- d) 3.40 eV

73. Given a uniform mass distribution of the disc galaxy, which of the following is the correct representation of tangential velocity as a function of radius (assume no dark matter)?



74. 1 *parsec* in centimeters is

- a) 3.086×10^{18}
- b) 3.086×10^{15}
- c) 3.086×10^{17}
- d) 3.086×10^{14}

75. Given the bolometric magnitude of Deneb = -8.38, find the luminosity of Deneb in terms of solar luminosity (bolometric magnitude of the sun is = 4.24).

- a) 111640 times solar luminosity
- b) 111686 times Solar luminosity
- c) 100000 times solar luminosity
- d) 100500 times Solar luminosity

76. Upper crust is made up of granite. What is the lower crust made up of

- a) Syenite
- b) Adamellite
- c) Granulite
- d) Quartzite

77. Which of the following relation is true in case of circumpolar stars? where δ is declination and ϕ is latitude of the place.

- a) $\delta + \phi \geq 90^\circ$
- b) $\delta + \phi = 90^\circ$
- c) $\delta + \text{Hour angle} = 90^\circ$
- d) $\delta + \text{Hour angle} \geq 90^\circ$

78. Given that the hour angle of vernal equinox is 8 hours and right ascension of a star is 6 hours, find the hour angle of the star.

- a) 2 hours
- b) 14 hours
- c) 1 hours
- d) we need more information to calculate this

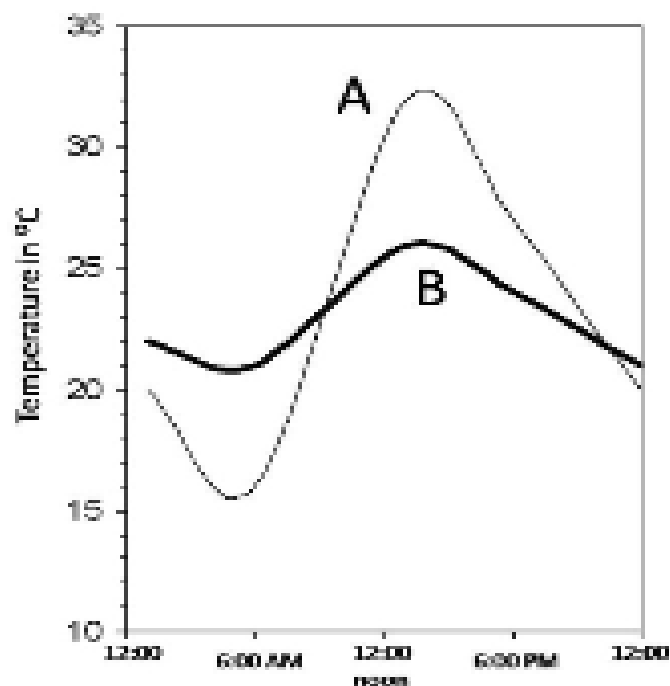
79. The focal ratio of a 10 inches aperture telescope is 0.4. Calculate the focal length of the telescope in mm is.

- a) 1100 mm
- b) 1000 mm.
- c) 1200 mm
- d) 1400 mm

80. Parabolic mirror is used in a reflecting telescope to get rid of which of the following aberrations?

- a) Coma
- b) Spherical aberration
- c) Astigmatism
- d) Chromatic aberration

81. Calculate the apparent recession velocity of a galaxy at redshift of 0.1.
- 3×10^7 m/s
 - 3×10^6 m/s
 - 3×10^5 m/s
 - 3×10^4 m/s
82. What is the correct order of the Earth's atmospheric layers from surface of the Earth to the top?
- Stratosphere, Mesosphere, Exosphere, Troposphere, Thermosphere
 - Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere
 - Mesosphere, Stratosphere, Troposphere, Thermosphere, Exosphere
 - Troposphere, Mesosphere, Stratosphere, Thermosphere, Exosphere
83. Most of the tropical cyclones originate in which region?
- Over the sub-tropical regions
 - Between 10 and 20 degree North and South of the Equator
 - To the east of easterly winds
 - Between 0 and 5 Degree North and South of the Equator
84. Albedo is the fraction of which of the following.
- Radiation reflected by the Earth
 - Momentum and energy received by the atmosphere
 - Moisture and water content of the atmosphere
 - Greenhouse gas and oxygen in the atmosphere
85. The graph given below depicts the daily temperature cycle at Bhopal for two days. Which of the following statements is correct?



- a) Graphs A and B represent the temperature cycle of a cloudy day
- b) Graph A represents the temperature cycle of a clear day and graph B represents the temperature cycle of a cloudy day
- c) Graphs A and B represent the temperature cycle of a clear day
- d) Graph A represents the temperature cycle of a cloudy day and Graph B represents the temperature cycle of a clear day

86. Which region on the surface of the Earth receives more solar energy?

- a) High-Latitudes Regions
- b) Sub-tropical Regions
- c) Equatorial Regions
- d) Mid-Latitudes Regions

87. Depletion of ozone in the Earth's atmosphere will cause which of the following process?

- a) Decrease in the UV radiation reaching to the Earth's Surface
- b) Decrease in atmospheric temperature
- c) Increase in the UV radiation reaching to the Earth's Surface
- d) Decrease in the Earth's UV radiation

88. Which of the following is associated with Aeronomy?

- a) Botany
- b) Chemical composition
- c) Oceanography
- d) Radiation from space

89. Different types of solar radiations are causing different types of effects. Which of the following is correct?

- a) Infrared causes more heating effects
- b) Infrared causes more chemical effects
- c) Ultraviolet causes more heating effects
- d) Infrared causes more visible effects

90. What will be the mean molecular weight of the atmosphere consisting of N_2 , O_2 and Ar only, given that the molecular weights of N_2 , O_2 and Ar are 28.01, 32 and 39.85 respectively?

- a) 28.00 b) 28.97 c) 29.00 d) 32.12

91. Different types of aerosols are causing different types of effects in the radiation balance of the atmosphere. Which of the following statement is incorrect?

- a) Black carbon rich aerosols cause cooling
- b) Black carbon rich aerosols cause heating
- c) Sulphate rich aerosols cause cooling
- d) None of the above

92. Remote sensing is very good technique for atmospheric studies. Which of the following is incorrect regarding remote sensing?

- a) Remote sensing is of two types: Active and Passive
- b) Signal is transmitted and received in the active remote sensing
- c) Signal is not transmitted only received in the passive remote sensing
- d) Signal is transmitted and received in the passive remote sensing

93. Turbulence is one of the processes taking place in the different regions of the Earth's atmosphere. Which of the following statement is correct about turbulence?

- a) Turbulence is very strong in the troposphere
- b) Turbulence is very weak in the troposphere
- c) Turbulence is very strong in the stratosphere
- d) No turbulence in the mesosphere

94. A mineral popularly known as 'fools' gold belongs to which group

- a) oxides b) Carbonates c) Sulphides d) Arsenides

95. Assume the Sun and the Earth behaving like black bodies at mean temperatures 6000 K and 300 K, respectively. What will be the ratio (Sun: Earth) of the emitted wavelengths from the Sun & Earth?

- a) 1:1
- b) 1:20
- c) 20:1
- d) 2:1

96. Visibly, sometimes, clouds look different in colours, but most of the times clouds look white. Due to which process the clouds look white?

- a) Rayleigh scattering
- b) Raman scattering
- c) Resonance scattering
- d) Mie scattering

97. Space weather effects are less pronounced in low latitude regions, why?

- a) Low latitude regions are having shield of geomantic filed lines
- b) Low latitude regions are getting more solar flux
- c) Low latitude regions are surrounded by oceans
- d) Low latitude regions are having open geomantic filed lines

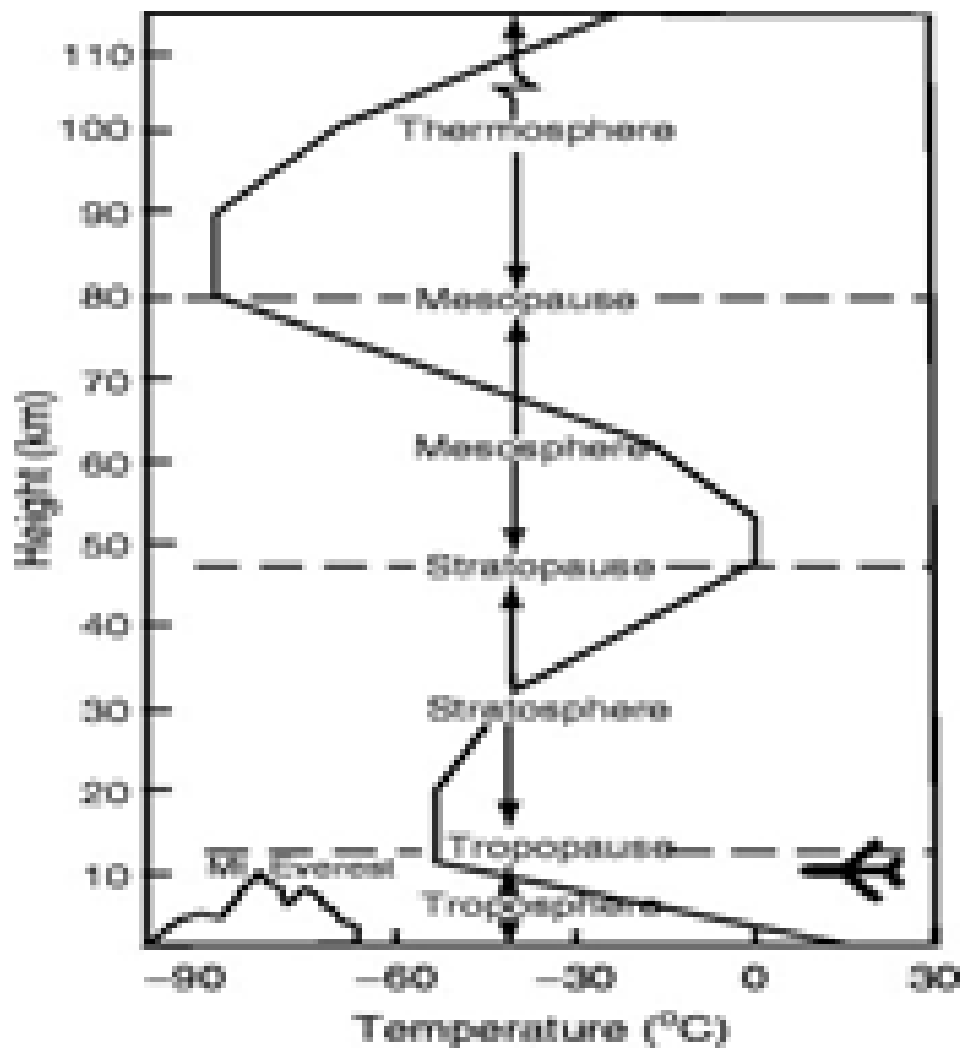
98. A westerly wind means a

- a) Wind in the Northern hemisphere
- b) Wind coming from the West
- c) Wind in Southern hemisphere
- d) Wind coming from the East

99. The age of the Deccan volcanism is around

- a) 55 million yrs
- b) 66 million yrs
- c) 5 million yrs
- d) 4.5 billion yrs

100. From the figure given below find out which two atmospheric layers have temperature profiles that promote convection?



- a) Mesosphere and Stratosphere
- b) Mesosphere and Thermosphere
- c) Mesosphere and Troposphere
- d) Stratosphere and Thermosphere