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# **ENTRANCE EXAMINATION 2023**

Ph.D. - Earth, Ocean and Atmospheric Sciences

Date:		
Duration:		Marks: 70

## Instructions:

- 1. All questions carry equal marks.
- 2. There is no negative marking.
- 3. Write your Hall Ticket Number in the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided above.
- 4. The questions are fully objective and the answers are to be marked on the OMR answer sheet following the instructions provided there upon.
- 5. At the end of the examination, hand over the OMR answer sheet 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. The following statements (i) to (iv) describe the objectives of research
  - i) To gain familiarity with a phenomenon or to achieve new insights into it.
  - ii) To portray accurately the characteristics of a particular individual, situation or group.
  - iii) To determine the frequency with which something occurs or the process through which it is associated with something else.
  - iv) To test a hypothesis of a causal relationship between variables.

Which of the following statements is correct?

- A. (iv) is the correct answer
- B. (iv) is the correct answer and is correctly explained by only (i)
- C. (iv) is the correct answer and is correctly explained by (i) and (iii)
- D. (iv) is the correct answer and is correctly explained by only (ii)
- 2. Excluding the stoppages, the speed of a bus is 64 km/hr and including the stoppages, the speed of the bus is 48 km/hr. For how many minutes does the bus stop per hour?
  - A. 10
  - B. 15
  - C. 25
  - D. 35

- 3. Truth, belief and justification related to knowledge in research is contained in which term/terms below
  - i) Metaphysics
  - ii) Epistemology
  - iii) Logic
  - iv) Aesthetics

Which of the following options is correct?

- A. (i) and (iv) together
- B. (ii) and (iv) together
- C. (iii)
- D. (ii)
- 4. In how many ways can the letters of the word 'FIGHT' be arranged?
  - A. 100
  - B. 120
  - C. 98
  - D. 150
- 5. Which of the following statements best describes statistical significance?
  - A. It indicates the practical importance or magnitude of an observed effect.
  - B. It suggests that the observed effect is unlikely to have arisen purely by random variation.
  - C. It definitively proves that the alternative hypothesis is true, and the null hypothesis is false.
  - D. It measures the strength and direction of the linear relationship between two variables.
- 6. A systematic step-by-step procedure following a logical process of reasoning is termed
  - i) Experiment
  - ii) Observation
  - iii) Deduction
  - iv) Scientific method

Which of the following statements is correct?

- A. (i), (ii) and (iv) explain the term satisfactorily
- B. (ii) and (iv) explain the term satisfactorily
- C. (iv) is correct
- D. (ii) is correct
- 7. In data analysis, what does the term 'outlier' refer to?
  - A. Data point that is significantly different from other data points
  - B. A missing value in a data set
  - C. The average value of a data set
  - D. A duplicate data point

- 8. If the standard deviation of a data set is small, it indicates that
  - A. The data are close together
  - B. The mean of the data can never be zero
  - C. All of the data have the same value
  - D. The data are far apart
- 9. Which technique is used to group similar data points together?
  - A. Classification
  - B. Regression
  - C. Clustering
  - D. Association
- 10. Which of the following is statement about linear correlation is FALSE?
  - A. It measures the strength and direction (sign) of a linear relationship.
  - B. It can be significantly influenced by outliers.
  - C. It is unrelated to regression
  - D. Its values range from -1 to +1.
- 11. If a number '1005A4' is completely divisible by 8, then the smallest integer in place of 'A' will be
  - A. 0
  - B. 1
  - C. 4
  - D. 2
- 12. Derivative of sinx with respect to  $x^2$  is
  - A. cosx
  - B. cosx/2x
  - C. cosx/x
  - D. Zero
- 13. Which of the following is true for the hypothetico-deductive method in research?
  - i) It encourages the use of exploratory studies.
  - ii) It is the basis for testing statistical significance.
  - iii) It is a computer problem to help researchers to improve the quality of their hypotheses.
  - iv) It encourages the development of specific hypotheses based on empirically derived theories.

Which of the following statements is correct?

- A. (i), (ii) and (iii) explain the method in the true sense
- B. (ii) and (iv) explain the method in the true sense
- C. (iv) is correct
- D. (ii) is correct

14. The length of a rectangle is reduced by 20%, and the breadth is kept constant, and the new figure that is formed is a square.

Consider the following statements

- i) The area of the square is 25% less than the area of the rectangle
- ii) The perimeter of the square is approximately 11% less than the perimeter of the rectangle
- iii) The diagonal of the square is approximately 12% less than the diagonal of the rectangle.

Which of the statements given above is/are correct?

- A. (i) only
- B. (i) and (ii)
- C. (ii) and (iii)
- D. (i), (ii) and (iii)
- 15. What is the benefit of ensembles of experiments or ensembles of model simulations?
  - A. It provides uncertainty estimates
  - B. It improves model resolution
  - C. It reduces computational costs
  - D. It simplifies model complexity
- 16. If two lines represented by  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  are parallel, then

  - A.  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ B.  $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ C.  $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ D.  $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
- 17. Which of the following situations is best represented by a Gaussian distribution?
  - A. The number of emails received by a server in a minute.
  - B. The scores on a standardized IQ test for a large population.
  - C. The number of times a specific word appears in a chapter of a book.
  - D. The probability that a basketball player makes 7 out of 10 free throws.
- 18. What should come in place of 'A' in the following series: 110, 55, 55, 110, A, 3520
  - A. 425
  - B. 380
  - C. 440
  - D. None of the above
- 19. If A is the brother of B, C is the sister of B, and B is the father of D, how is D related to A?
  - A. Nephew/Niece
  - B. Niece
  - C. Nephew
  - D. Cousin

- 20. Hypothesis must have
  - i) Applicability
  - ii) Durability
  - iii)Testability
  - iv) Measurement

Which of the following statements is correct?

- A. (i) and (ii) only are correct
- B. (i) and (iv) only are correct
- C. (iii) is correct
- D. (iv) is correct
- 21. Which technique is commonly used to forecast future values based on past data?
  - A. Time Series Analysis
  - B. Regression Analysis
  - C. Clustering
  - D. Association
- 22. Which of the following statements is true regarding even and odd functions?
  - A. An even function f(x) satisfies f(-x) = -f(x), and its graph is symmetric about the x-axis.
  - B. An odd function f(x) satisfies f(-x)=f(x), and its graph is symmetric about the y-axis.
  - C. The product of two odd functions is an odd function.
  - D. The interval of an odd function over a symmetric interval [-t, t] is always zero.
- 23. The purpose of research is
  - i) to extend the conceptual understanding of a topic.
  - ii) that empirical work should be testing a theory.
  - iii) primarily to get more data.
  - iv) to produce work of publishable quality.

Which of the following statements is correct?

- A. (i) is correct
- B. (iii) and (iv) only serve the purpose of research
- C. (iv) is the correct answer and is correctly supported by (iii)
- D. (iv) is the correct answer and is correctly supported by only (i)
- 24. The value of  $5^{1/4}$  x  $(125)^{0.25}$  is
  - A. 0.5
  - B. 25
  - C.  $5\sqrt{5}$
  - D. 5
- 25. Find  $\frac{dy}{dx}$ , if  $y = e^{-3logx}$ 
  - A.  $\frac{-3}{r^4}$

B.  $\frac{3}{x^4}$ 

C.  $-3e^{-3 \log x}$ 

D.  $3e^{-3 \log x}$ 

<ul><li>i) Theory</li><li>ii) Generalization</li><li>iii) Scientific evolution</li><li>iv) Scientific concept</li></ul>	
Which of the following statements is correct A. (i) and (iv) only are correct B. (i) is correct C. (iii) is correct, but not (iv) D. (ii) is correct	?
<ul> <li>27. A scientific method adopted in research comprise</li> <li>i) Empirical evidence</li> <li>ii) Ethical neutrality</li> <li>iii) Probabilistic predictions</li> <li>iv) All of the above</li> </ul>	ses of
Which of the following statements is correct A. (i) and (ii) only are correct B. (iv) is correct C. (iii) is the correct answer, but not (iv) D. (ii) is correct	:?
<ul> <li>28. In a set of data, if all the data appears with the s</li> <li>A. The standard deviation is always 0.</li> <li>B. The mean is always larger than the stand C. All of the data have the same value.</li> <li>D. The boxplot does not always look symmetric control of the data have the same value.</li> </ul>	lard deviation.
29. Consider a pouch containing 3 white and 2 blac without replacement, the probability that both $A. \frac{1}{10}$	
C. $\frac{3}{5}$	O. $\frac{3}{10}$
30. What does the term 'overfitting' in statistical operation A. A model that performs well on test data be B. A model that performs well on both train C. A model that performs poorly on both train D. A model that performs well on training definition.	out poorly on training data ing and test data aining and test data
31 What is the role of an independent variable in e	xperimental research?

26. A hypothesis contributes to the development of:

A. To be manipulated by the researcher B. Depending on the outcome variable

D. To be controlled for statistical analysis

C. To measure the relationship between variables

- 32. In statistical analysis, a one-tailed test is also known as
  - A. Non-directional test
  - B. Directional test
  - C. Confirmatory test
  - D. Randomized test
- 33. The list of all population units from which sample is selected is known as
  - A. Sampling design
  - B. Population Frame
  - C. Sampling Frame
  - D. Sampling Unit
- 34. Which statistical test is used for assessing the associateship between two continuous variables?
  - A. Chi-Square test
  - B. Mann-Whitney U test
  - C. Pearson's correlation coefficient
  - D. Independent samples t-test
- 35. What type of hypothesis states the absence of a relationship or effect?
  - A. Null Hypothesis
  - B. Alternate Hypothesis
  - C. Research Hypothesis
  - D. Experimental Hypothesis

## **PART-B**

- 36. The acceleration due to gravity of the earth attains its maximum
  - A. on the surface
  - B. at the centre of the earth
  - C. in the atmosphere above the topography
  - D. at 520 m depth from the topography
- 37. In basic rocks, high-pressure granulites are characterized by the key mineral association of
  - A. Garnet + Plagioclase + Quartz
  - B. Garnet + Orthopyroxene + Clinopyroxene + Quartz
  - C. Garnet + K-feldspar + Kyanite
  - D. Garnet + Clinopyroxene + Plagioclase + Quartz
- 38. Which of the following satellites is a Geostationary satellite?
  - A. INSAT
  - B. CARTOSAT
  - C. OCEANSAT
  - D. RESOURCESAT
- 39. The key agency of meridional heat transport in the midlatitude is due to
  - A. Baroclinic Eddies
  - B. Hadley Cell
  - C. ENSO
  - D. Land-sea temperature gradient

40. In kinetic isotope fractionation involving stable isotopes of Carbon and Oxygen, \$^{12}C^{16}O_{2}\$ can diffuse further than \$^{13}C^{16}O_{2}\$ in a given amount of time.  Select the correct options given below  A. 1.19%  B. At equal rates C. 29% D. None of the above  41. The vertical zone of the ocean, where rapid change in salinity takes place, is called A. SOFAR channel B. Pyenocline C. Halocline D. Thermocline  42. The length of a copper wire is reduced by half and its cross-sectional area is increased by four times, then its resistivity A. increased by two times B. decreased by two times C. remains unchanged D. increased by three times  43. Which of the following UV radiation may penetrate through the stratospheric ozone layer and cause skin cancer? A. UV-C B. UV-A C. UV-B D. UV-A and UV-B  44. Most of the marine living organisms are found in zone A. Hadal zone B. Mixed layer zone C. Aphotic zone D. Euphotic zone  45. Among the following, the statement that DOES NOT apply to a cyclostrophic flow is A. It is a balance between pressure gradient force and Centrifugal force B. It cannot be anticyclonic C. Curvature of its radius is small D. Dust devil is an example of it  46. Referring to the solar abundance of elements, consider the following statements i) Sawtooth Pattern of Elemental Distribution ii) Big negative anomaly for Boron, Beryllium and Lithium iii) Hydrogen is most abundant, Uranium is least abundant iv) Moderate positive anomaly for Iron Which of the following statements is correct? A. (ii) is correct B. All statements are correct C. (iii) is correct B. All statements are correct C. (iii) is correct D. (iv) is the correct answer and is correctly explained by only (i)		
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- 47. Perthite texture is a result of which process?
  - A. Secondary reactions and replacement
  - B. Exsolution
  - C. Secondary twinning
  - D. Polymorphic transformation
- 48. Which of the following is the coldest point temperature in Earth's atmosphere
  - A. Tropical Tropopause
  - B. Stratopause
  - C. Mesospause
  - D. Zero-degree isotherm at 5 km
- 49. High magnetic field anomalies and low gravity anomalies are usually associated with
  - A. Volcanic tuff
  - B. Batholiths
  - C. Dolerite dykes
  - D. Sills
- 50. In the vorticity equation expressed in isobaric coordinates, the following contribution is negligible
  - A. Divergence term
  - B. Tipping term
  - C. Solenoidal term
  - D. None the above
- 51. The semi-diurnal tidal pattern has
  - A. One high-tide and one low-tide in a solar day
  - B. Two high-tides and two low-tides in a solar day
  - C. One high-tide and one low-tide in a lunar day
  - D. Two high tides and two low-tides in a lunar day
- 52. A recumbent fold is one where the axial plane of the fold is
  - A. Vertical
  - B. Inclined
  - C. Horizontal
  - D. Curved
- 53. Porphyry Cu-(Mo) type of ore deposits re associated with which rock type?
  - A. Basic
  - B. Felsic
  - C. Intermediate to felsic
  - D. Basic to intermediate
- 54. Given that the Sun's maximum emission wavelength is 0.6 µm at a temperature of 6000 K, and assuming Earth radiates as a blackbody with a temperature of 255 K, the wavelength of Earth's peak thermal emission is

A. 23 μm

B. 46 µm

C. 0.026 µm

D. 14 µm

55. Which geophysical method is preferable to explore disseminated sulphides A. Gravity B. Induced polarization C. Magnetic D. Seismic reflection 56. Identify the dominant process for Rip current generation A. ocean heating B. waves C. winds D. long-shore currents 57. In the concept of a theoretical aqua-planet \_\_\_\_\_\_ is abundant (more) A. land is abundant B. vegetation is abundant C. water is abundant D. radiation 58. The summer monsoon depressions in the Bay of Bengal rarely intensify into tropical cyclones owing to A. local SST intensity B. a low latitude C. strong vertical wind shear D. associated heavy precipitation 59. The mineral formula of lawsonite is A. CaAl<sub>2</sub>Si<sub>2</sub>O<sub>7</sub>(OH)<sub>2</sub>H<sub>2</sub>O B.  $Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$ C. NaAlSi<sub>3</sub>O<sub>8</sub> D.  $[Na_2][Mg_3Al_2]Si_8O_{22}(OH)_2$ 60. Identify the primary driver for ocean currents A. winds B. gravitational forces C. differences in ocean density D. winds and differences in ocean density 61. Aulacogens are formed because of A. Igneous intrusions B. Failed rift system C. Listric faults D. Strike-slip faults 62. Increasing global warming since 1950s CANNOT be attributed to A. increasing CO<sub>2</sub> emissions B. increasing methane C. water vapor feedback D. Sulphur dioxide

- 63. Identify the phenomena that highly influences marine productivity
  - A. Ocean tides
  - B. Internal waves
  - C. Upwelling
  - D. Ocean mixing
- 64. Which ocean phenomenon is characterized by the warming of sea surface temperatures in the central and eastern Pacific Ocean?
  - A. El Niño
  - B. La Niña
  - C. Tsunami
  - D. Monsoon
- 65. Arêtes are residual landforms produced by
  - A. Fluvial processes
  - B. Marine processes
  - C. Aoelian processes
  - D. Glacial processes
- 66. Trilobites made their first appearance in the
  - A. Devonian period
  - B. Cambrian period
  - C. Carboniferous period
  - D. Ordovician period
- 67. The process of fluidizing water-saturated soil during an earthquake is known as
  - A. Gelatinization
  - B. Quicksand
  - C. Liquefaction
  - D. None of these.
- 68. Seismologists locate the epicenter of an earthquake by
  - A. Measuring the amplitude of surface waves
  - B. Triangulating data from three or more seismograph stations
  - C. Measuring the intensity of ground shaking
  - D. Calculating the duration of the earthquake
- 69. In which of the following electromagnetic method, are the field strength ratio and relative phase difference measured between two receiver coils?
  - A. Sundberg Compensator Method
  - B. TURAM Method
  - C. SLINGRAM Method
  - D. Fixed Vertical Loop Method
- 70. Which physical property of the medium governs the response of Ground Penetrating radar?
  - A. Dielectric Permittivity
  - B. Electromagnetic Conductivity
  - C. Electrical Conductivity
  - D. Seismic wave velocity

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# University of Hyderabad ENTRANCE EXAMINATION – 2025

#### Ph.D. Admissions

School/Department/Centre: CEOAS, School of Physics

Course: Ph.D.

Subject: Earth Sciences

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	А	26	В	51	D
2	В	27	В	52	С
3	D	28	В	53	С
4	В	29	Α	54	D
5	В	30	D	55	В
6	С	31	А	56	D
7	Α	32	В	57	С
8	Α	33	С	58	С
9	С	34	С	59	Α
10	С	35	Α	60	D
11	Α	36	Α	61	В
12	В	37	D	62	D
13	С	38	А	63	С
14	С	39	Α	64	Α
15	Α	40	Α	65	D
16	С	41	С	66	В
17	В	42	С	67	С
18	С	43	Α	68	В
19	А	44	D	69	В
20	С	45	В	70	А
21	Α	46	В		
22	D	47	В		
23	А	48	С		
24	D	49	А		
25	А	50	С		

Note/Remarks:

Date: 17.06.2025

Signature School/Department/Centre

Prof. V. Chakravarthi Head Centre for Earth, Ocean & Atmospheric Sciences University of Hyderabad Hyderabad-500 046 INDIA