

Code No. A-53

**ENTRANCE EXAMINATION, 2021**  
**QUESTION PAPER BOOKLET**  
**PH.D. (EARTH, OCEAN & ATMOSPHERIC SCIENCES)**

Marks : 70

Time : 2:00 hrs.

Hall Ticket No.:

**Instructions**

- i) Write your Hall Ticket Number in the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided above.
- ii) **There is no negative marking.**
- iii) Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
- iv) Hand over the OMR answer sheet at the end of the examination to the Invigilator.
- v) No additional sheets will be provided. Rough work can be done in the question paper itself / space provided at the end of the booklet.
- vi) The question papers which are fully in objective type to be answered in OMR sheet.
- vii) Only scientific non-programmable calculators are permitted. Mobile phone-based calculators are not permitted. Logarithmic tables are not allowed.
- viii) This question paper booklet contains 11 pages.

**PART A**

1. A main difference between the z and t-test is that
  - A. for a t-test, the population mean and standard deviation are needed
  - B. for a t-test only the sample mean is needed
  - C. for a z-test the sample mean and standard deviation are needed
  - D. the z and t-test are identical except for the size of the sample used.
2. A term used to describe, when you present the work of another researcher as your own.
  - A. Duplication
  - B. Copying
  - C. Plagiarism
  - D. Innovation

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3. Which of the following is TRUE about the "Scientific method"
  - A. It relies on empirical evidences;
  - B. It utilizes relevant concepts;
  - C. It results into probabilistic predictions;
  - D. All of the above
  
4. The sum of the first N even numbers is represented by
  - A.  $N^2$
  - B.  $N^2+1$
  - C.  $N(N+1)$
  - D.  $N^2-1$
  
5. If you have a specific idea about what is to be researched you should
  - A. Formulate research objective
  - B. Write a research proposal
  - C. Talk to your supervisor
  - D. Follow the twelve steps of selecting a research problem.
  
6. The most common questions in academic work are conceptual. A question is conceptual when:
  - A. Your answer to the question helps the readers to understand some issues
  - B. Your answer to the question tells the readers what to do
  - C. Your answer to the question tells the readers what not to do
  - D. Your answer to the question helps to fix a practical problem
  
7. If the sample size increases the sampling error would
  - A. Decrease
  - B. Increase
  - C. Remains as it is
  - D. Both A and B
  
8. What are the critical values for a one-independent sample nondirectional (two-tailed) z-test at a  $\alpha = 0.05$  level of significance?
  - A.  $\pm 1.96$
  - B.  $\pm 1.645$
  - C.  $\pm 2.58$
  - D.  $\pm 3.30$
  
9. What is the main aim of interdisciplinary research?
  - A. To over simplify the problem of research
  - B. To bring out the holistic approach to research
  - C. To create a new trend in research methodology
  - D. To reduce the emphasis on a single subject in the research domain
  
10. Find the one which does not belong to the group
  - A. 36
  - B. 49
  - C. 100
  - D. 81

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11. A pair of words is given below, followed by four pair of words as alternatives. Choose the pair in which the words bear the same relationship to each other as the words of given words bear. ARROW: QUIVER

- A. Fear: Tremble
- B. Coin: Mint
- C. Sound: Music
- D. Money: Bank

12. Random sampling is also called

- A. Availability sampling
- B. Prospect sampling
- C. Systematic sampling
- D. Probability sampling

13. For a given hypothesis test, the  $p$ -value is 0.09, the null hypothesis

- A. must be rejected at any level
- B. must be rejected at the 0.05 level
- C. must not be rejected at the 0.05 level
- D. may or may not be rejected at the 0.05 level

14. What helps when developing a research question?

- A. Formulating objective
- B. Knowledge of the subject area
- C. Specific guidelines in other books
- D. A big budget

15. If the coefficient of determination is close to zero, we interpret that

- A. The case cannot be decided because zero makes no sense
- B. There is a total dependence between the variables
- C. There is a negative dependence between the variables
- D. One variable has no impact on the other

16. Which of the following statements is/are correct?

- A. A distribution that is more peaked than normal is called platykurtic.
- B. A distribution that is less peaked than normal is called leptokurtic.
- C. A bell-shaped curve or the normal curve is called mesokurtic.
- D. None of the above.

17. In a hypothesis testing, which statement represent the two-tailed test:

- A.  $H_0: \mu \geq \mu_0, H_1: \mu < \mu_0$
- B.  $H_0: \mu \leq \mu_0, H_1: \mu > \mu_0$
- C.  $H_0: \mu = \mu_0, H_1: \mu \neq \mu_0$
- D.  $H_0: \mu = \mu_0, H_1: \mu > \mu_0$

18. An objective perspective in research is based on

- A. Empirical results
- B. Experiments conducted
- C. Opinions
- D. Both A and B but not C

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19. A working hypothesis is:

- A. Is just a hypothesis and it cannot be used to guide your research.
- B. Is a hypothesis that seems promising and is used to guide your research, even if the hypothesis ultimately fails.
- C. Is a hypothesis that seems promising and is used to guide your research, and the hypothesis can't go wrong.
- D. Is the ultimate guide to your research.

20. Since the last one year, after a 125 basis point reduction in repo rate by the Reserve Bank of India, banking institutions have been making a demand to reduce interest rates on small saving schemes. Finally, the government announced yesterday a reduction in interest rates on small saving schemes to bring them on par with fixed deposit interest rates.

Which one of the following statements can be inferred from the above?

- A. Whenever the Reserve Bank of India reduces the repo rate, the interest rates on small savings schemes are also reduced.
- B. Interest rates on small saving schemes are always maintained on par with fixed deposit interest rates.
- C. The government sometimes takes into consideration the demands of banking institutions before reducing the interest rates on small saving schemes.
- D. A reduction in interest rates on small saving schemes follow only after a reduction in repo rate by the Reserve Bank of India

21. What is the decision for  $z_{obt} = 2.10, \alpha = 0.05$  in two-tailed test?

- A. Retain the null hypothesis
- B. Reject the null hypothesis
- C. partially retain the alternative hypothesis
- D. partially reject the alternative hypothesis

22. Developing a researchable question would not involve

- A. Deciding what statistical software to use
- B. Assessing the work involved
- C. Considering the time and resource available to you
- D. Bearing in mind your technical expertise in the area of research

23. Which of the following is classified under 'types of research'

- A. Descriptive research
- B. Analytical research
- C. Qualitative research
- D. All of the above

24. 'Hypothesis' in research leads to the development of

- A. Facts
- B. Theory
- C. Observations
- D. Simulations

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25. Research Design does not include
- A. Data analysis design
  - B. Sampling design
  - C. Historical design
  - D. Any of the above
26. Probability of getting a total of 6 upon two throws of a dice is
- A.  $1/36$
  - B.  $5/36$
  - C.  $2/6$
  - D.  $1/6$
27. If the length of each edge of a cube is increased by 25%, then the percentage increase in volume would be approximately
- A. 95%
  - B. 75%
  - C. 57%
  - D. 81%
28. A Research design is
- A. A way of conducting research that is not grounded in theory.
  - B. A conceptual structure within which research would be conducted.
  - C. The style in which you present your research findings, such as a graph.
  - D. The choice between using qualitative or quantitative methods.
29. A scientific method adopted in research comprises of
- A. Empirical evidence
  - B. Ethical neutrality
  - C. Probabilistic predictions
  - D. All of the above
30. One of the important aspects of a research work is that it must be \_\_\_\_\_ if one follows similar procedures.
- A. Replicable
  - B. Non-replicable
  - C. All of the above
  - D. None of the above
31. The overwhelming number of people infected with rabies in India has been flagged by the World Health Organization (WHO) as a source of concern. It is estimated that inoculating 70% of pets and stray dogs against rabies can lead to a significant reduction in the number of people infected with rabies.
- Which of the following can be logically inferred from above sentences?
- A. The number of people in India infected with rabies is high.
  - B. The number of people in other parts of the world who are infected with rabies is low.
  - C. Rabies can be eradicated in India by vaccinating 70% of stray dogs.
  - D. Stray dogs are the main source of rabies worldwide.

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32. What is the major attribute of Correlation Analysis?
- A. Association among variables
  - B. Difference among variables
  - C. Regression among variables
  - D. Variations among variables
33. Epistemology is the branch of philosophy that deals with
- A. Creation of knowledge
  - B. Dissemination of knowledge
  - C. Sources of knowledge
  - D. All of the above
34. A local school reports that its average GPA is  $2.66 \pm 0.40(\mu \pm \sigma)$ . The school announces that it will be introducing a new program designed to improve GPA scores at the school. What is the effect size ( $d$ ) for this program if it is expected to improve GPA by 0.05 points?
- A. 0.125
  - B. 0.25
  - C. 1.00
  - D. 0.20
35. The term 'plagiarism' comes under which of the following?
- A. Code of research ethics
  - B. Steps in scientific research
  - C. Design in scientific methodology
  - D. None of the above

### PART B

36. Levees known as natural embankments of the river system are evolved by
- A. deposition of coarsest sediments deposited at channel edges during the flood period.
  - B. repeated floods that cause the mounds to build up on flanks of the channel.
  - C. a deposition of river flood load over the flood plain due to a drop in the river's velocity.
  - D. distinct fluvial processes comprised of a variety of depositional environments.
37. Crenulation cleavage develops during
- A. Thrusting
  - B. Rifting
  - C. Superimposed deformation
  - D. Extension
38. Causal systems are the systems in which
- A. The output of the system depends only on the present inputs.
  - B. The output of the system depends only on the past inputs.
  - C. The output of the system depends on the present and the past inputs.
  - D. The output of the system depends on the present input as well as the previous outputs.

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39. The dry adiabatic lapse rate ( $^{\circ}\text{C.km}^{-1}$ ) in the atmosphere is, approximately,
- A. 9.8
  - B. 1
  - C. 6.3
  - D. 4
40. Vertical motions in the atmosphere result from
- A. convection from solar heating of the Earth's surface
  - B. horizontal flow over topographic features at the Earth's surface
  - C. buoyancy caused by the release of latent heat as water condenses
  - D. All of the above
41. Positive Ce anomalies in sediments indicate
- A. Reducing environments
  - B. Oxidizing environment
  - C. Low PH-conditions
  - D. High PH environment
42. If a person walks on the geoid surface, he/ she would observe the following
- A. gravity always pointing exactly downwards, but weight could slightly change from one place to another.
  - B. strength of the gravity is constant at any point on the geoid surface.
  - C. force of gravity is perpendicular to the geoid surface, but weight is constant along the surface.
  - D. since the surface is a mathematical surface, the force of gravity will have some amount of deflection.
43. Among the following statements, which one does not apply to a barotropic instability?
- A. Horizontal shear in zonal wind of the Jet streams can lead to this.
  - B. Mean kinetic energy converts to eddy kinetic energy.
  - C. Horizontal gradient of temperature is the energy source
  - D. It can explain formation of several synoptic disturbances in tropics
44. The characteristic texture of komatiites is
- A. Porphyritic
  - B. Sperulitic
  - C. Spinifex
  - D. Orbicular
45. In electromagnetic (EM) sounding, the depth of investigation \_\_\_\_\_ with increasing frequency.
- A. increases
  - B. decreases
  - C. remains unchanged
  - D. varies randomly

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46. About what percentage of ozone found the stratosphere?
- A. 30%
  - B. 90%
  - C. 50%
  - D. 10%
47. The shadow zone is the region, where both P and S waves disappear. What is the cause for disappearing of S wave?
- A. because of presence of various seismic discontinuities at different depths within the earth.
  - B. because of no shear wave propagates through the outer core.
  - C. because of decrease of wave velocity in the outer core.
  - D. because of refraction of S-waves through the fluid and solid cores.
48. The ENSO intensifies the northeast monsoon, unlike summer monsoon, because
- A. the ENSO weakens by this season.
  - B. ENSO invariably changes its phase during October-December.
  - C. the soil moisture from the preceding summer monsoon.
  - D. the mean seasonal pattern of the winds over India.
49. Stishovite is a high-pressure polymorph of
- A. Olivine
  - B. Garnet
  - C. Zeolite
  - D. Quartz
50. By using which geophysical method mineral discrimination can be done?
- A. Self-Potential
  - B. Magnetic
  - C. Seismic
  - D. Induced Polarisation
51. As the temperature increases the relaxation time of charge carriers of a conductor
- A. increases
  - B. decreases
  - C. remains constant
  - D. first increase and then decrease
52. 'Squids' are the present-day representatives of
- A. Brachiopods
  - B. Cephalopods
  - C. Gasteropods
  - D. Lamellibranchs
53. Prescription of antisymmetric Matsuno-Gill heating across equator DOES NOT result in
- A. Rossby-Gravity waves
  - B. Rossby waves propagating west
  - C. Kelvin waves along the equator
  - D. Northerly winds in the lower levels along the equator

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54. The Sm-Nd isotopic composition of depleted mantle
- A. High  $^{147}\text{Sm}/^{144}\text{Nd}$  and high  $^{143}\text{Nd}/^{144}\text{Nd}$
  - B. Low  $^{147}\text{Sm}/^{144}\text{Nd}$  and low  $^{143}\text{Nd}/^{144}\text{Nd}$
  - C. High  $^{147}\text{Sm}/^{144}\text{Nd}$  and low  $^{143}\text{Nd}/^{144}\text{Nd}$
  - D. Low  $^{147}\text{Sm}/^{144}\text{Nd}$  and high  $^{143}\text{Nd}/^{144}\text{Nd}$
55. Which of the following ocean covers largest surface of the Earth?
- A. the Pacific Ocean
  - B. the Atlantic Ocean
  - C. the Indian Ocean
  - D. The Arctic Ocean
56. The convolution of two finite length sequences  $X[n] = [2, 0, 1]$  and  $Y[n] = [4, 3, 2, 1]$  is
- A.  $[4, 3, 10, 7, 4, 2]$
  - B.  $[3, 3, 5, 6, 8, 9]$
  - C.  $[8, 6, 8, 5, 2, 1]$
  - D.  $[2, 5, 6, 7, 9, 2]$
57. The layer in a water body where the rate of change of density in the vertical is maximum is called
- A. oxycline
  - B. Pycnocline
  - C. thermocline
  - D. halocline
58. The characteristic mineral of lower mantle
- A. Rutile
  - B. Anatase
  - C. Perovskite
  - D. Spinel
59. Pick the wrong statement from the following relationships between the parameters of permeability, porosity and grain size of a rock formation.
- A. The rock consists of small grain size less than 5 microns has high porosity values.
  - B. Permeability of a rock depends upon the connectivity of the flow paths exist within
  - C. Both parameters, permeability and porosity largely depend on grain size.
  - D. The rock consists of high grain size more than 100 microns has a large range of porosity values and a short range of permeability values.
60. Which of the following statements is FALSE?
- A. Oceanic surface evaporation is higher in subtropics than equator
  - B. Surface salinity in the Atlantic is less than that in the Pacific.
  - C. In subtropical oceans, evaporation exceeds precipitation
  - D. High values of salinity found in Mediterranean

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61. The first primitive mammals have appeared during
- A. Triassic
  - B. Palaeocene
  - C. Carboniferous
  - D. Permian
62. Choose correct order of electromagnetic spectrum from low to high wavelength
- A. Gamma, Cosmic, X-ray, UV, Visible, Infrared, Radio
  - B. Cosmic, X-ray, Gamma, UV, Visible, Infrared, Radio
  - C. Cosmic, Gamma, X-rays, UV, Visible, Infrared, Radio
  - D. Gamma, X-ray, UV, Visible, Radio, Infrared
63. After applying the gravity corrections to the measured gravity data in regional geological mapping, the Bouguer gravity anomalies are deemed to have been made on
- A. the geoid
  - B. the spheroid
  - C. the respective station elevations
  - D. partly on the geoid and partly on the spheroid
64. The greatest mass extinction event occurred in the Earth history during
- A. End of Permian
  - B. Middle of Jurassic
  - C. Early Cambrian
  - D. Late Eocene
65. What is a typical size of cloud condensation nuclei?
- A. 0.01  $\mu\text{m}$
  - B. 0.1  $\mu\text{m}$
  - C. 1  $\mu\text{m}$
  - D. 10  $\mu\text{m}$
66. At low magnetic latitudes, north-south striking 2D bodies magnetized purely by induction shall produce
- A. strong magnetic anomalies in vertical component
  - B. strong magnetic anomalies in horizontal component
  - C. no significant magnetic anomalies in any component
  - D. strong total magnetic anomalies
67. Mixed layer of the ocean, in general communicates with the thermocline, except
- A. northern north Atlantic
  - B. tropical pacific
  - C. Bay of Bengal
  - D. South China Sea
68. Choose the correct increasing order of major constituents of sea water
- A. sodium, chlorine, sulfate
  - B. chlorine, sodium, sulfate
  - C. chlorine, sodium, calcium
  - D. sodium, chlorine, calcium

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- 69. Main Central thrust in Himalayan orogen separates**
- A. Siwalik hills and lesser Himalayan sequences**
  - B. Subathu Formation and lesser Himalayan sequences**
  - C. Lesser Himalayan sequences and high Himalayan crystallines**
  - D. None of above**
- 70. The average sea surface salinity is about**
- A. 0.3516 g/kg**
  - B. 3.516 g/kg**
  - C. 35.16 g/kg**
  - D. None of the above**

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**PART-A**

|    |   |
|----|---|
| 1  | B |
| 2  | C |
| 3  | D |
| 4  | C |
| 5  | A |
| 6  | A |
| 7  | A |
| 8  | A |
| 9  | B |
| 10 | B |
| 11 | D |
| 12 | D |
| 13 | C |
| 14 | B |
| 15 | D |
| 16 | C |
| 17 | C |
| 18 | D |
| 19 | B |
| 20 | C |
| 21 | B |
| 22 | A |
| 23 | D |
| 24 | B |

|    |   |
|----|---|
| 25 | A |
| 26 | B |
| 27 | A |
| 28 | B |
| 29 | D |
| 30 | A |
| 31 | A |
| 32 | A |
| 33 | D |
| 34 | A |
| 35 | A |

**PART-B**

|    |   |
|----|---|
| 36 | B |
| 37 | C |
| 38 | C |
| 39 | A |
| 40 | D |
| 41 | B |
| 42 | A |
| 43 | C |
| 44 | C |
| 45 | B |
| 46 | B |
| 47 | B |

|    |   |
|----|---|
| 48 | D |
| 49 | D |
| 50 | D |
| 51 | B |
| 52 | B |
| 53 | C |
| 54 | A |
| 55 | A |
| 56 | C |
| 57 | B |
| 58 | C |
| 59 | D |
| 60 | B |
| 61 | A |
| 62 | C |
| 63 | C |
| 64 | A |
| 65 | B |
| 66 | C |
| 67 | A |
| 68 | * |
| 69 | C |
| 70 | C |

**NOTE:**

\*Marks to be awarded to all students