

Code No. Y-66

**ENTRANCE EXAMINATION, 2020**  
**QUESTION PAPER BOOKLET**  
**Ph.D. (OCEAN & ATMOSPHERIC SCIENCES)**

Marks : 70

Time : 2:00 hrs.

Hall Ticket No.:

**Read carefully the following instructions**

- i) Please enter your Hall Ticket Number on the OMR Answer Sheet given to you and the space provided above.
- ii) This Question paper has two parts: **Part - A** and **Part - B**.
- iii) **Part - A** consists of 35 objective type questions and **Part - B** consists of 35 objective type questions. Each question carries one mark.
- iv) **There is negative marking. Each wrong answer carries -0.33 marks.**
- v) Answers are to be marked on the OMR answer sheet following the instructions provided there upon. An example is show here  
70.     A     B     C
- vi) Hand over the OMR answer sheet at the end of the examination to the Invigilator.
- vii) No additional sheets will be provided. Rough work can be done in the question paper itself / space provided at the end of the booklet.
- viii) Only scientific non-programmable calculators are permitted. Mobile phone based calculators are not permitted. Logarithmic tables are not allowed.
- ix) This question paper booklet contains 14 pages.

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**PART - A**

1. How many words can be formed out of the letters of the word 'EDUCATION' such that vowels occupy the odd positions?

- A. 1440
- B. 2880
- C. 2840
- D. None of these

2. In a class, 30% of students passed English, 20% passed French and 10% passed both. If a student is selected at random, what is the probability that he has English or French?

- A.  $\frac{2}{5}$
- B.  $\frac{3}{4}$
- C.  $\frac{3}{5}$
- D.  $\frac{3}{10}$

3. If 1,000 copies of a book of 25 sheets require 50 reams of paper, how much paper is required for 5,000 copies of a book of 32 sheets?

- A. 160
- B. 480
- C. 640
- D. 320

4.

BD <sub>3</sub>	CE <sub>5</sub>	DF <sub>15</sub>
EG <sub>2</sub>	FH <sub>4</sub>	GI <sub>8</sub>
HJ <sub>4</sub>	IK <sub>6</sub>	?

- A. JL<sub>24</sub>
- B. JL<sub>10</sub>
- C. LJ<sub>24</sub>
- D. JL<sub>12</sub>

5. Statements: Sopan is a good scientist. Scientist are hardworking

Conclusions: I. All hardworking person are scientist.

II. Sopan is hardworking

- A. Only conclusion I follows
- B. Only conclusion II follows
- C. Neither I nor II follows
- D. Both I and II follows

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6. In an office, the distribution of work hours is as shown in the following table

No. of staff members	No. of hours worked
5	0-19
12	20-24
25	25-29
40	30-34
15	35-39
8	40-45

Consider the following inferences drawn from the table.

- (i) The average number of hours worked by a staff member is about 30
- (ii) The percentage of those worked 35 or more hours is less than 25
- (iii) At least 5 staff members worked more than 44 hours

Which of these inferences is/are valid?

- A. (i) alone
- B. (ii) alone
- C. (i) and (ii)
- D. (i), (ii) and (iii)

7. Average age of employees working in a department is 30 years. In the next year, ten workers will retire, what will be the average age in the next year?

Statement I: Retirement age is 60 years

Statement II: There are 50 employees in the department

- A. Statement I alone is sufficient to answer the question and Statement II alone is not required to answer the question
- B. Statement II alone is sufficient to answer the question and Statement I alone is not required to answer the question
- C. Both Statements I and II are not sufficient to answer the question
- D. Both Statements I and II together are necessary to answer the question

8. Q is 14 km south and 16 km west of P. The distance of Q from P is

- A. 15.6 km
- B. 18.8 km
- C. 21.2 km
- D. 25.8 km

9. If  $\sqrt{1 + \frac{x}{144}} = \frac{13}{12}$ , then the value of x is

- A. 5
- B. 25
- C. 12.5
- D. 35

10. The average of ten numbers is 7. If each number of multiplied by 12, then the average of the new set of number is

- A. 94
- B. 19
- C. 82
- D. 84

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11. Three numbers are in the ratio 4:5:6 and their average is 25. The largest number is

- A. 30
- B. 32
- C. 36
- D. 42

12.  $\frac{180 \times 15 - 12 \times 20}{140 \times 8 + 2 \times 55} = ?$

- A.  $\frac{1}{7}$
- B.  $\frac{4}{5}$
- C. 2
- D. 4

13. The population of a town increased from 1,75,000 to 2,62,500 in a decade. The average percent increase of population per year is

- A. 4.37%
- B. 5%
- C. 6%
- D. 8.75%

14. In terms of increasing reliability of geophysical interpretation, which order among the following techniques, is correct?

- I. Trial and error
- II. Newton's forward difference approximation
- III. Levenberg - Marquardt algorithm
- IV. Particle Swarm Optimization

- A. II, I, III, IV
- B. III, I, IV, II
- C. I, II, III, IV
- D. IV, III, II, I

15. In terms of increasing natural remnant magnetizations of different rock formations, which order among the following, is correct?

- I. Granite
- II. Diabase
- III. Limestone
- IV. Basalt

- A. II, III, IV, I
- B. IV, II, I, III
- C. IV, III, I, II
- D. III, I, II, IV

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16. In terms of increasing resistivities, which order among the following is correct?

- I. Rock salt
- II. Compact shale
- III. Lime stone
- IV. Sandstone

- A. II, IV, III, I
- B. IV, I, II, III
- C. III, II, I, IV
- D. I, III, II, IV

17. In terms of increasing densities, which order among the following is correct?

- I. Ryolite
- II. Sandstone
- III. Basalt
- IV. Eclogite
- V. Granite

- A. I, V, II, IV, III
- B. V, I, III, IV, II
- C. V, I, II, III, IV
- D. II, I, V, III, IV

18. A man is facing south. He turns  $135^\circ$  in anti-clockwise direction and then  $180^\circ$  in clockwise direction. Which direction he is facing now?

- A. North-east
- B. North-west
- C. South-east
- D. South-west

19. The average weight of a class of 30 students is 40 kg. If, however, the weight of the teacher is included, the average becomes 41 kg. The weight of the teacher is

- A. 31 kg
- B. 71 kg
- C. 62 kg
- D. 60 kg

20. In the interpretation of geophysical data by inversion, which order among the following is correct?

- I. Initialisation of model space
- II. Removal/suppression of unwarranted noise
- III. Forward modelling
- IV. Improvisation of model space
- V. Calculation of data misfit

- A. V, I, II, IV, III
- B. I, V, III, IV, II
- C. IV, I, III, V, II
- D. II, I, III, V, IV

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21. Five numbers 10, 7, 5, 4 and 2 are to be arranged in a sequence from left to right following the directions given below:

1. No two odd or even numbers are next to each other.
2. The second number from the left is exactly half of the left-most number.
3. The middle number is exactly twice the right-most number.

Which is the second number from the right?

- A. 2
- B. 4
- C. 7
- D. 10

22. 10 coaches of a passenger train have got derailed and have blocked the railway track from both the ends. Courses of action:

- I. The railway authorities should immediately send men and equipment and clear the spot.
- II. All the trains running both directions should be diverted immediately via other routes.

- A. If only I follows
- B. If only II follows
- C. If either I or II follows
- D. If both I and II follows

23. The length, breadth and height of a room are in the ratio of 3:2:1. if its volume be  $1296 \text{ m}^3$ , find its breadth.

- A. 12 metres
- B. 18 metres
- C. 16 metres
- D. 24 metres

24. The following lines A to D describes the objectives of the research:

- a. To gain familiarity with a phenomenon or to achieve new insights into it.
- b. To portray accurately the characteristics of a particular individual, situation or a group.
- c. To determine the frequency with which something occurs or with which it is associated with something else.
- d. To test a hypothesis of a causal relationship between variables.

Which of the following options is correct?

- A. Only d
- B. Both a and d
- C. Both c and d
- D. All the above

25. The essential qualities which a researcher should possess are:

- a. Spirit of free enquiry.
- b. Reliance on observation and evidence.
- c. Systematization or theorizing of knowledge.
- d. Critical evaluation of generated data.

- A. Both b and d
- B. Both a and d
- C. Both c and d
- D. All the above (a-d)

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26. Which of the following is not covered under Intellectual Property Rights?
- A. Copyrights
  - B. Patents
  - C. Trade Marks
  - D. Thesaurus
27. Which one of the following is not the correct option for the types of research
- A. Descriptive vs. Analytical
  - B. Applied vs. Fundamental
  - C. Conceptual vs. Empirical
  - D. Logical vs. Illogical
28. Truth, belief and justification related to knowledge in research is termed
- A. Metaphysics
  - B. Epistemology
  - C. Logic
  - D. Aesthetics
29. Why is it important to read original articles when you are reviewing the literature?
- A. To obtain an overview of methods and procedures
  - B. To examine the validity of the conclusions
  - C. To look for flaws in the method
  - D. All of these
30. If you find that someone else publishes work similar to yours before your project is completed, what could you do?
- A. Completely revamp your ideas so you are not replicating their study
  - B. There is nothing you can do so do not mention it in your study
  - C. Acknowledge it in your report and evaluate the study
  - D. Change your hypotheses and aims
31. What is the HCF of 1266, 1461 and 1863?
- A. 3
  - B. 6
  - C. 9
  - D. 12
32. In how many ways, a committee of 3 members can be selected from 5 men and 4 women, consisting of 2 men and 1 woman?
- A. 60
  - B. 72
  - C. 40
  - D. 32
33. Two numbers are in the ratio 1:2. If 7 is added to both, their ratio changes to 3:5. The greatest number is
- A. 24
  - B. 26
  - C. 28
  - D. 32

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34. What percent of a 7.2 Kilogram is 18 gram?

- A. 0.025%
- B. 0.25%
- C. 2.5%
- D. 25%

35. The average of 50 numbers is 30. If two numbers, 35 and 40 are discarded, then the average of the remaining numbers is nearly

- A. 28.32
- B. 28.78
- C. 29.27
- D. 29.68

**PART - B**

36. The first great oxidation event occurred during
- A. 2900 Ma
  - B. 3400 Ma
  - C. 2700 Ma
  - D. 2300 Ma
37. Consider the earth as a rotating solid sphere with angular velocity 'W'. If 'R' is the radius of the earth the difference in gravity values between the poles and equator equals to
- A.  $RW^2$
  - B.  $WR^2$
  - C.  $W/R$
  - D.  $R/W$
38. One of the following has the lowest albedo
- A. vegetation
  - B. snow
  - C. clouds
  - D. water
39. Temperature of Venus (+464 °C) is anomalously high because
- A. Its lack an atmosphere
  - B. it is nearby Sun and rotates slowly on its axis
  - C. Excessive volcanism
  - D. A dense atmosphere of greenhouse gas  $CO_2$
40. Consider the following statements to the characteristic of Clays
- I) High porosity and lower permeability
  - II) High permeability and high porosity
  - III) Low porosity and highest permeability
  - IV) Low permeability and highest porosity
- A. I and II
  - B. I and IV
  - C. III and IV
  - D. II and III
41. If  $x_i$  represents a set of n sampled values, the geometric mean can be obtained as
- A.  $\left[ \frac{1}{n} \sum x_i^2 \right]^{1/2}$
  - B.  $\left[ \frac{1}{n} \sum x_i^2 \right]$
  - C.  $\left[ \frac{1}{n} \sum x_i \right]$
  - D.  $\left[ \frac{1}{2n} \sum x_i^2 \right]$

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42. Given a growing cumulonimbus cloud with updraft strength of 4 m/s. If the droplet terminal velocity is -4 m/s, the droplet will

- A. remain suspended in the cloud
- B. begin to fall in the cloud
- C. begin to rise in the cloud
- D. None of these

43. Which of the following is not necessary to Baroclinic instability?

- A. horizontal temperature gradient
- B. vertical wind shear
- C. horizontal wind shear
- D. conversion of eddy available energy to eddy kinetic energy

44. Considering the following pairs fossils

I. Trilobite	1. Eocene
II. Cephalopods	2. Cambrian
III. Mammals	3. Jurassic
IV. Dinosaurs	4. Cretaceous

Which of the pairs given above is/are correctly matched?

- A. I-2; II-4; III-1; IV-3
- B. I-1; II-2; III-3; IV-4
- C. I-3; II-1; III-4; IV-2
- D. I-4; II-3; III-2; IV-1

45. In a resistivity sounding survey with the Schlumberger electrode configuration apparent resistivity data is should be collected along profiles

- A. Parallel to the expected strike of formations
- B. Perpendicular to the expected strike of formations
- C. At 45 degrees to the expected strike of formations
- D. At 40 degrees to the expected strike of formations

46. Statement I: The equator is warmer than the poles.

Statement II: Hot air rises

- A. Statement I is true, Statement II is also true and Statement II is the correct explanation of Statement I
- B. Statement I is true, Statement II is also true and Statement II is not the correct explanation of Statement I
- C. Statement I is true, Statement II is false
- D. Statement I is false, Statement II is true

47. In isobaric system of vorticity equation, the term that is not present is

- A. divergence
- B. solenoidal term
- C. tipping term
- D. viscosity term

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48. Which one of the following tectonic features is a consequence of continent-continent collision?

- A. Mariana trench
- B. Himalaya
- C. Island-arc
- D. Mid-Atlantic Ridge

49. Consider the following statements:

- I. Flute marks are erosional sedimentary structures formed before the deposition of the overlying bed.
- II. Cross bedding is a syn-depositional structure formed during sedimentation.
- III. Ripple marks is a syn-depositional structure formed during sedimentation and are indicative of shallow water deposition.
- IV. Mud cracks are secondary sedimentary structures and formed before the deposition of the overlying bed.

Which of the following statements is/are correct?

- A. I only
- B. I and II
- C. I, II and III
- D. II and IV

50. Which of the following is not a form of precipitation?

- A. Rain
- B. Sleet
- C. Fog
- D. Snow

51. The positive Indian Ocean Dipole involves, along the equator

- A. upwelling Kelvin waves
- B. downwelling Kelvin waves
- C. upwelling westward Rossby waves
- D. shallow water gravity waves

52. Ophitic textures are observed in

- A. Igneous rocks
- B. Sedimentary rocks
- C. Metamorphic rocks
- D. Limestones

53. Darcy's law states that

- I. The discharge is directly proportional to head loss and area of flow
- II. The discharge is inversely proportional to head loss and area of flow
- III. The discharge is inversely proportional to the length of the path
- IV. The discharge is directly proportional to the length of the path.

Which of the following statements are correct?

- A. I and II
- B. II and IV
- C. I and III
- D. III and IV

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54. Remote sensing techniques make use of the properties of this type of waves emitted, reflected or diffracted by the sensed objects

- A. Sound waves
- B. Electromagnetic waves
- C. Wind waves
- D. Electric waves

55. Nitrogen-based fertilizer run-off from crops into our oceans

- A. increases biological productivity
- B. decreases biological productivity
- C. no effect on phytoplankton
- D. none of the above

56. Consider the following pairs: Which of the pairs are correctly matched?

I. cassiterite	1. Hexagonal
III. Olivine	2. Orthorhombic
IV. Apatite	3. Monoclinic
V. Malachite	4. Tetragonal

- A. I-4; II-2; III-1; IV-3
- B. I-1; II-2; III-4; IV-3
- C. I-2; II-1; III-4; IV-3
- D. I-3; II-4; III-2; IV-1

57. Glaucophane is a mineral associated with

- A. Greenschist facies
- B. Blueschist facies
- C. Granulite facies
- D. Eclogite facies

58. Age of the earth is estimated to be about 4.5 billion years based on isotopes, such as  $U^{238}$ , whose half life is about 4.5 billion years. If the half-life of  $U^{238}$ , were 9.0 billion years, then the age of the Earth would be

- A. 4.5 billion years
- B. 9.0 billion years
- C.  $4.5 \times e^{-9.0}$  year
- D.  $9.0 \times e^{4.5}$  year

59. Why are algae commonly grouped in colour categories, such as 'red' algae, 'brown' algae, and 'green' algae?

- A. external colour
- B. internal colour
- C. photosynthetic pigments
- D. none of the above

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60. Consider the following statements:

Statement I: the variation of the Earth's magnetic field is stronger during the day than that during the night

Statement II: Magnetic materials become less magnetic on heating

- A. Statements I and II are true; II explains I
- B. Statements I and II are true; but II does not explain I
- C. Statement I and II are false
- D. Statement I is false; II is true

61. In a medium other than air, the electric flux density will be

- A. Divergent
- B. Solenoidal
- C. Curl free
- D. Irrotational

62. The oceans are 4 billion years old, but the oldest ocean basin is only about 200 million years old. Which theory can completely justify this statement

- A. Continental Drift
- B. Seafloor Spreading
- C. Plate Tectonics
- D. Mantle Plume

63. A very stable magnetization which can exist unchanged for long intervals of geologic time is

- A. Thermo Remanent Magnetization (TRM)
- B. Sedimentary Remanent Magnetization (SRM)
- C. Chemical Remanent Magnetization (CRM)
- D. Viscous Remanent Magnetization (VRM)

64. Choose the correct pair:

a. Fault	1. Duplex
b. Fold	2. Boudins
c. Thrust	3. Dome
d. Extension	4. Mylonites

- A. a-4, b-3, c-2, d-1
- B. a-4, b-3, c-1, d-2
- C. a-2, b-1, c-3, d-4
- D. a-1, b-2, c-3, d-4

65. The density of the core ranges between

- A. 3.3-5.4 g/cm<sup>3</sup>
- B. 9.5-14.5 g/cm<sup>3</sup>
- C. 2.5-3.3 g/cm<sup>3</sup>
- D. 5.0-6.7 g/cm<sup>3</sup>

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66. The oceans have  $1.4 \times 10^{21}$  kg of water, and each kilogram contains 35 g of dissolved salts. If we assume for simplicity a total of 1 km thickness of salt evaporates over the Mediterranean seafloor (area  $\sim 2 \times 10^6$  km<sup>2</sup>) and an average density of salt is  $2 \times 10^3$  kg m<sup>-3</sup>. What percentage of Mediterranean evaporates compared to world oceans?

- A. 8% of the salt in the world oceans
- B. 10% of the salt in the world oceans
- C. 5% of the salt in the world oceans
- D. 3% of the salt in the world oceans

67. One of the following currents is a southward flowing western boundary current

- A. Kuroshio
- B. Oyashio
- C. Gulf Stream
- D. Peru current

68. The electric flux density of a material whose charge density is given by 18 units in a volume region of 0.5 units is

- A. 24
- B. 12
- C. 18
- D. 9

69. If North America and Africa are drifted 5000 km apart from each other within a period of 200 Myrs. What is the rate of spreading?

- A. 2.5 m/yr
- B. 5.0 m/yr
- C. 2.5 cm/yr
- D. 5.0 cm/yr

70. The energy of one photo of ultraviolet light of wavelength of  $2 \times 10^{-8}$  m and planck's constant of  $4.1357 \times 10^{-15}$  eV·s is approximately equal to

- A. 62 eV
- B. 52 eV
- C. 72 eV
- D. 82 eV