Roll No. | | | | | | | | |

(Write Roll Number from left side exactly as in the Admit Card)

Signature of Invigilator

Question Booklet Series **X**

PAPER–II

Question Booklet No.
(Identical with OMR Answer Sheet Number)

Subject Code : 27

EARTH SCIENCES

Time : 2 Hours *Maximum Marks: 200*

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
2. At the commencement of the examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and verify it:
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
   (ii) Faulty booklet, if detected, should be got replaced immediately by a correct booklet from the invigilator within the period of 5 (five) minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) Verify whether the Question Booklet No. is identical with OMR Answer Sheet No.; if not, the full set is to be replaced.
   (iv) After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet.
3. This paper consists of One hundred (100) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
4. Each Question has four alternative responses marked: (A) (B) (C) (D) . You have to darken the circle as indicated below on the correct response against each question.

   Example: (A) (B) ● (D), where (C) is the correct response.
5. Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Rough work is to be done at the end of this booklet.
7. If you write your Name, Phone Number or put any mark on any part of the OMR Sheet, except in the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
9. You have to return the Original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry question booklet and duplicate copy of OMR Sheet after completion of examination.
10. **Use only Black Ball point pen.**
11. **Use of any calculator, mobile phone, electronic devices/gadgets etc. is strictly prohibited.**
12. **There is no negative marks for incorrect answer.**

PAPER II

(EARTH SCIENCES)

1. When two laterally migrating meanders cut through a bedrock spur is called as
(A) Natural Arch
(B) Entrenched meanders
(C) Ingrown meanders
(D) Knick point

2. During deformation a material line of 20 cm length is elongated by 5 cm. What would be the quadratic elongation associated with the line?
(A) 1
(B) 2·56
(C) 0·56
(D) 1·56

3. The average length of channel per unit area of drainage basin is known as
(A) Drainage density
(B) Length density
(C) Bifurcation ratio
(D) Circularity ratio

4. Which of the following is common in the Precambrian rock record before the great oxidation event but is non-existant after that?
(A) Red beds
(B) Granulite facies rocks
(C) Stromatolites
(D) Detrital Uraninite

5. In convergent margin if a part of the oceanic crust overrides the continental crust then the mechanism is called as
(A) Subduction
(B) Obduction
(C) Rifting
(D) Sagduction

6. Choose the correct option representing increasing Mud: Sand ratio from left to right.
(A) Wavy bedding—Lenticular bedding—Flaser bedding
(B) Lenticular bedding—Wavy bedding—Flaser bedding
(C) Flaser bedding—Wavy bedding—Lenticular bedding
(D) Lenticular bedding—Flaser bedding—Wavy bedding

7. Which of the following stratigraphic units is associated with the Singhbhum Crator?
(A) Dongargarh Supergroup
(B) Sargur Group
(C) Dhanjoni Group
(D) Hindoli Group

8. Which of the following statements is *not true* regarding the oceanic crust?
(A) Oceanic crust destroys along subduction gones.
(B) New oceanic crust forms along spreading centres in the ocean floor.
(C) Oceanic crust is denser than the continental crust.
(D) The age of the oldest oceanic crust existing today is Late Triassic.

9. According to Koppen's climate classification, the wet tropics are represented as
(A) Af, Am
(B) Cfa
(C) BS
(D) BW

10. Which of the following rock type is found in Archaean age greenstone belts only?
(A) Komatiite
(B) Basalt
(C) Rhyolite
(D) Andesite

11. By which of the following processes were the sediments of Cuddapah Supergroup deposited?
(A) Deltaic processes
(B) Shore and Shelf processes
(C) Lacustrine processes
(D) Fluvial processes

12. Which one of the following grain-size ranges indicates sand sized particles?
(A) 1/16 to 2 mm
(B) 2 mm to 4 mm
(C) 1/16 to 1/64 mm
(D) 1/64 to 1/256 mm

13. Which of the following structures found in sandstones of shallow-marine setting is considered to indicate storm activity during the deposition?

(A) Trough cross-lamination
(B) Interference ripple-marks
(C) Climbing ripple cross-lamination
(D) Hummocky cross-stratification

14. Which of the following is a phosphatic microfossil?

(A) Foraminifera
(B) Coccolithophore
(C) Radiolaria
(D) Conodont

15. The greatest concentration of radiogenic heat sources of the earth is in the _____.

(A) upper crust
(B) lower crust
(C) upper mantle
(D) lower mantle

16. Active mountain fronts are recognized by which of the following values of 'Mountain front sinuosity (Smf)'?

(A) 1·6–2·0
(B) 2·0–2·6
(C) 1·0–1·6
(D) 2·6–3·0

17. Which of the following is the correct decreasing order of the abundance of four major permanent gases in the atmosphere near the earth's surface?

(A) Oxygen, Nitrogen, Argon and Neon
(B) Nitrogen, Oxygen, Argon and Neon
(C) Oxygen, Nitrogen, Neon and Argon
(D) Nitrogen, Oxygen, Neon and Argon

18. Presence of graded bedding in sedimentary rocks indicates which of the following mode of deposition?

(A) Current activity
(B) Wave activity
(C) Pause in sedimentation
(D) Sediment settling out of suspension

19. Minerals showing uniaxial behaviour crystallize in following crystal system(s).

(A) Orthorombic and triclinic
(B) Orthorombic, monoclinic and triclinic
(C) Triclinic only
(D) Trigonal, tetragonal and hexagonal

20. Which of the following statements is *not true* about the global distribution of pelagic sediments in world's oceanic basins?

(A) Calcareous oozes accumulate on the sea floor that is shallower than the Carbonate Compensation Depth.
(B) Foraminiferal oozes contribute to nearly half of the total pelagic deposits.
(C) Both siliceous oozes and pelagic clays accumulate below the Carbonate Compensation Depth.
(D) The proportion of siliceous ooze is ten times more than that of the pelagic clays.

21. Which one of the following dating methods is not used in Neotectonic studies?

(A) U-Pb Zircon dating
(B) Radio Carbon dating
(C) Cosmogenic radio nucleide dating
(D) Luminescence dating

22. Sedimentary basins forming in front of a rising mountain belt are known as

(A) Rift basins
(B) Fore deep
(C) Back deep
(D) Back-arc basins

23. A crescent-shaped dunes form by wind action is termed as

(A) Barchan
(B) Free dunes
(C) Linear dunes
(D) Parabolic dunes

24. Which one of the following gases is most abundant in the atmosphere of Mars?

(A) Nitrogen
(B) Oxygen
(C) Hydrogen
(D) Carbon dioxide

25. Coal with the highest calorific value —
(A) Anthracite
(B) Bitumen
(C) Sub-bitumen
(D) Lignite

26. Interference colour of a mineral depends upon
(A) thickness, orientation and birefringence.
(B) thickness, refractive index and extinction.
(C) refractive index, birefringence and optic axial angle.
(D) length fast and length slow character.

27. Geostrophic ocean currents are the result of a balance between
(A) wind stress and pressure gradient.
(B) wind stress and coriollis force.
(C) pressure gradient force and coriollis force.
(D) gravitational force and wind stress.

28. In seismology a P wave that successively passes through the mantle-core-mantle is labelled as
(A) PKP
(B) PcP
(C) PPP
(D) PKS

29. When the Earth, Moon and Sun are in alignment, gravitational forces combine to form a
(A) Flood tide
(B) Spring tide
(C) Ebb tide
(D) High tide

30. On the Richter Scale, a 5.0 earthquake is _____ times stronger than a 4.0 earthquake and _____ times stronger than a 3.0 earthquake.
(A) 10, 100
(B) 2, 4
(C) 1, 10
(D) 100, 10

31. Age of the Mars is
(A) 4·6 billion years
(B) 4·7 billion years
(C) 4·8 billion years
(D) 4·9 billion years

32. Following condition (out of the given alternatives) favours ultra-high pressure metamorphic rocks
(A) Plume-ridge interaction
(B) Plume-lithosphere impingement
(C) Mid-ocean rift ridge
(D) Deep subduction zone

33. Gosan is developed due to
(A) reduction of oxides.
(B) oxidation of sulphides.
(C) oxidation of both sulphides and oxides.
(D) reduction of both oxides and sulphides.

34. Differentiation of a magma by the Soret effect requires
(A) magma-mingling.
(B) crystal-settling in the magma chamber.
(C) maintenance of strong temperature gradient in the magma chamber.
(D) assimilation between parent magma and the country rock.

35. The height of a wind generated wave in a function of all of the following except:
(A) The wind velocity
(B) The duration of time of wind blowing
(C) The latitude of the storm
(D) The wind fetch

36. With which of the following types of clouds do lightening, thunder and large hail typically occur?
(A) Nimbostratus
(B) Stratocumulus
(C) Cumulus congestus
(D) Cumulonimbus

37. For the age determination of a basaltic rock (which had suffered multiple deformation), you should prefer to date the rock using:
(A) K-Ar method
(B) Rb-Sr method
(C) Sm-Nd method
(D) C^{14} method

38. The equation $v = \sqrt{gd}$ where 'v' is the wave velocity, 'd' is the depth of ocean water where the wave is occurring and 'g' is the acceleration of gravity, describe
(A) Deep Water Waves
(B) Shallow Water Waves
(C) Intermediate Waves
(D) Storm Waves

39. Rocks in the Merrimack synclinorium, New Hampshire, USA passed through the Andalusite–Sillimanite–Kyanite fields. Therefore P-T-t path would be

(A) Clockwise
(B) Constant
(C) Initially clock-wise followed by anti-clockwise
(D) Anti-clockwise

40. The Malanjkhand granitoids intrude the _____ group and host _____ mineralization.

(A) Nandgaon; Cu
(B) Amgaon; Fe
(C) Chilpi; Mn
(D) Bengpal; Cr

41. One geologist has recorded a continuous intertrap bed while mapping a portion of Deccan Trap terrain. This intertrap corresponds to

(A) long channels through which Deccan lava erupted.
(B) vesiculation path of Deccan lavas.
(C) unconformity bound unit.
(D) presence of fault plane during Deccan lava eruption.

42. The earth's outer core is thought to be molten because

(A) P waves are not transmitted through it.
(B) S waves are not transmitted through it.
(C) L waves are not transmitted through it.
(D) Rayleigh waves are not transmitted through it.

43. Which of the following is known as Oddo-Harkin's Rule?

(A) Element of even atomic number is more abundant than both elements with adjacently larger and smaller odd atomic numbers.
(B) Element of odd atomic number is more abundant than both elements with adjacently larger and smaller even atomic numbers.
(C) Elements of odd and even atomic numbers show similar abundance.
(D) The relative abundances for elements of higher atomic number than nickel vary less than those of the lower atomic number.

44. Which among the following minerals can act as a lubricant during subduction of oceanic crust?

(A) Garnet
(B) Sanidine
(C) Omphacite
(D) Serpentine

45. An imperceptibly slow, downslope movement of soil and earth materials is called

(A) Creep
(B) Debris avalanches
(C) Earth flow
(D) Rock fall

46. World's largest known single deposit of uranium belongs to which type of deposit?

(A) Iron oxide-Cu-Gold
(B) Roll-front
(C) Unconformity-hosted
(D) Sedimentary exhalative

47. Fill up the gap in the following geobarometric expression with appropriate composition

$$3Ca\,Al_2Si_2O_8 = Ca_3\,Al_2Si_3O_{12} + \text{———} + SiO_2$$
(anorthite) (grossular) (quartz)

(A) $6Al_2O_3$
(B) $2Al_2SiO_5$
(C) Al_2O_3
(D) $2\,CaSiO_3$

48. Elements with high ionization potential (like *Ni*, *Co*, *Au*) are classified as

(A) Siderophile
(B) Chalcophile
(C) Lithophile
(D) Atmophile

49. Aulacogens form through which of the following tectonic processes?

(A) Continental rifting
(B) Collision of Continents
(C) Back-arc rifting
(D) Obduction of oceanic crust

50. The global sea level has been fluctuating over the time. It was approximately _____ below the present day level during the Last Glacial Maximum (LGM).

(A) 50 m
(B) 150 m
(C) 250 m
(D) 350 m

51. The property that tends to increase as one travels from the pole to the equator is

(A) Gravitational attraction
(B) Angular velocity
(C) Tangential velocity
(D) Weight

52. Which of the following surface ocean current is the warm-water current?

(A) Kuroshio current
(B) Falklana current
(C) Benguela current
(D) Labrador current

53. Monazite is

(A) a type of igneous rock.
(B) a phosphate of *Th*, *Y*, *La*, *Ce*.
(C) an oxide of *U, Au, Ni.*
(D) a type of metamorphic rock.

54. Which of the following gases has higher concentration in seawater?

(A) Carbon dioxide
(B) Nitrogen
(C) Carbon monoxide
(D) Argon

55. Which among the following stages of the Sausar–Sakoli series hosts manganese deposits?

(A) Bichua
(B) Chor baoli
(C) June wani
(D) Mansar

56. The drainage pattern, which develops on undeformed terrains where the underlying rock is of uniform resistance to erosion is known as

(A) Dentritic pattern
(B) Radial pattern
(C) Trellis pattern
(D) Rectangular pattern

57. Clouds made up of ice crystals are called

(A) Stratus
(B) Cirrus
(C) Cumulus
(D) Nimbus

58. Which of the following elements of seawater has least residence time?

(A) Cl^-
(B) Na^+
(C) Fe^{2+}
(D) Mg^{2+}

59. Wind in the southern hemisphere is deflected towards left due to

(A) temperature variations.
(B) rotation of the earth.
(C) difference in pressure.
(D) difference in water content.

60. Geochemical arsenic anomalies can be a pathfinder element for which mineralization?

(A) Uranium
(B) Gold
(C) Chromite
(D) PGE

61. The earth has a magnetic field because

(A) magnetic minerals are common at temperatures above the Curie point.
(B) it has a magnetic iron-nickel core.
(C) the liquid outer core creates an electric current which induces a magnetic field.
(D) all planets have magnetic fields when they form.

62. Which one of the following is an example of diamagnetic mineral?

(A) Magnetite
(B) Biotite
(C) Garnet
(D) Feldspar

63. Seismic waves are recorded by an instrument called a (1) _____ and the record of the earthquake that the instrument generates is called a (2) _____.

(A) (1) Seismograph (2) Seismometer
(B) (1) Seismograph (2) Seismogram
(C) (1) Seismometer (2) Seismograph
(D) (1) Seismogram (2) Seismometer

64. If the amount of angular shear (ψ) associated with a material line in a deformed body is 45°, what would be the value of shear strain (γ) associated with that line?

(A) 0·5
(B) 1·0
(C) 1·5
(D) 0

65. Which among the following assemblages is representative of propylitic alteration?

(A) Epidote, Chlorite, Pyrite
(B) Quartz, Sericite, Pyrite
(C) Biotite, Sericite, Orthoclase
(D) Illite, Kaolinite, Orthoclase

66. Which of the following bedding-cleavage relation develops at the overturned limb of a fold?

(A) Bedding and cleavage dip in opposite directions.
(B) Bedding is horizontal and cleavage is vertical.
(C) Bedding and cleavage dip in the same direction but bedding is steeper than cleavage.
(D) Bedding and cleavage dip in the same direction but cleavage is steeper than bedding.

67. How do you calculate Ripple Index?

(A) $\frac{\text{Ripple height}}{\text{Ripple length}}$
(B) $\frac{\text{Ripple length–Ripple height}}{\text{Ripple height}}$
(C) $\frac{\text{Ripple length–Ripple height}}{\text{Ripple length}}$
(D) $\frac{\text{Ripple length}}{\text{Ripple height}}$

68. What is the Formation Factor, given the resistivity of the matrix as 100 ohm-m and the resistivity of water as 20 ohm-m?

(A) 0·2
(B) 2·5
(C) 2·23
(D) 5

69. A fossil shell contains 12·5% of the original amount of carbon-14. How many years ago did the organism with the shell live?

(A) 5700
(B) 11400
(C) 17100
(D) 22800

70. Residual drawdown is related to

(A) loss of groundwater.
(B) no change in groundwater.
(C) recovery of groundwater.
(D) maximum lowering of groundwater.

71. Oscillatory zoning in plagioclase is best explained by

(A) syntectonic magmatic emplacement.
(B) increasing lithostatic pressure.
(C) fluctuating P_{H2O} condition in the magma.
(D) decreasing P_{H2O} in the magma chamber.

72. The liquids that were trapped in the pores of sedimentary rocks as they were deposited are termed as

(A) Connate waters
(B) Juvenile waters
(C) Meteoric waters
(D) Pore space waters

73. Which of the following stratigraphic units does contain dinosaur fossils?

(A) Lameta Bed
(B) Muth Quartzite
(C) Siwalik Group
(D) Subathu Formation

74. The core of an antiform fold is occupied by youngest rock, it may be called as

(A) Antiformal Syncline
(B) Synformal Anticline
(C) Synclinorium
(D) Anticlinorium

75. Which of the following stable isotopic ratios is used for palaeotemperature analysis of seawater?

(A) $^{18}O/_{16}O$
(B) $^{13}C/_{12}C$
(C) $^{87}Sr/_{86}Sr$
(D) $^{15}N/_{14}N$

76. The stress that tend to pull something apart is known as

(A) Tensile stress
(B) Compressional stress
(C) Confining stress
(D) Hydrostatic pressure

77. Which one of the following textures represent eutectic crystallization?

(A) Myrmekitic texture
(B) Porphyritic texture
(C) Poikilitic texture
(D) Intergranular texture

78. Anvil head is a term applied to:

(A) Any high cloud
(B) Nimbostratus clouds
(C) Cumulonimbus clouds
(D) All clouds that form on the windward side of mountains.

79. Paired metamorphic belt involves

(A) transform fault boundary.
(B) divergent plate boundary.
(C) convergent plate boundary.
(D) transcurrent fault boundary.

80. A line that connects points of equal inclination on the outer and inner bounding surfaces of a folded layer is called as

(A) Dip isogons
(B) Hinge line
(C) Fold axis
(D) Isocline

81. Martitic texture is

(A) replacement texture of magnetite by hematite.
(B) alteration texture of pyrrhotite to pyrite.
(C) exsolution texture of pentlandite in pyrrhotite.
(D) replacement texture of hematite by magnetite.

82. In granitic rock masses all three sets of joints being mutually at right angles to each other is termed as

(A) Systematic joints
(B) Columnar joints
(C) Mural joints
(D) Sheeting joints

83. Birnessite, todorokite and busenite are minerals associated with

(A) seamount cobalt crust.
(B) marine manganese nodules.
(C) white smoker deposits.
(D) radiolarian ooze deposits.

84. The point at which elastic deformation changes to plastic deformation is called as

(A) Yield stress
(B) Confining stress
(C) Deviatoric stress
(D) Tensile stress

85. Telson is a part of _____.

(A) Brachiopods
(B) Echinoidea
(C) Trilobites
(D) Corals

86. For Diapiric intrution of magma, pick up the correct answer from the following alternatives:

(A) Low density layer overlain by denser material.
(B) High density layer overlain by lighter material.
(C) It involves distribution of equal density throughout the magma chamber.
(D) Crystal settling controls the diapiric intrusion.

87. Cephalopods having suture lines with rounded saddles and angular lobes are known as

(A) Orthoceratite type
(B) Ceratite type
(C) Goniatite type
(D) Ammonoid type

88. For the lathanide series; pick up the correct answer.

(A) The lanthanide series have atomic numbers 57-71 and they are placed below the main block of the periodic table (within the 'f' block alongwith the actinides).
(B) They have atomic numbers 59-71 and they are placed at the top of the periodic table.
(C) They have atomic numbers 50-58 and they are placed at the middle of the periodic table.
(D) They have atomic numbers 62-75 and they are rarely found in the earth's crust; they are non-metals.

89. An image that has been geometrically corrected so that the image is uniform from edge to edge is knows as

(A) Orthophotograph
(B) Horizontal photograph
(C) Convergent photograph
(D) Trimetrogon photograph

90. The characteristic placement and arrangement of repetitions of tone or colour in an image is called as

(A) Tone
(B) Texture
(C) Shape
(D) Size

91. A metamorphic rock consisting of spessartine garnet, quartz, manganese silicates and oxides is known as

(A) Leptynite
(B) Charnocnite
(C) Gondite
(D) Khondalite

92. The seismic moment (M_0) of an earthquake can be used to compute its moment magnitude (M_w), using the equation _____ proposed by Aki and Richards (1980).

(A) $M_w = \frac{2}{3}\log_{10} M_0 - 10.7$

(B) $M_w = \frac{3}{2}\log_{10} M_0 - 10.7$

(C) $M_w = \frac{2}{3}\log_{10} M_0 + 10.7$

(D) $M_w = \frac{3}{2}\log_{10} M_0 + 10.7$

93. Which of the following genera is *not* a Lower Gondwana flora?

(A) *Noeggerathiopsis*
(B) *Nilssonia*
(C) *Euryphyllum*
(D) *Buridia*

94. Sun is the prime source of electromagnetic energy available in the earth and its atmosphere. According to Wein's displacement law, at what wavelength does the sun radiate most of its energy?

(A) 0·4 μm
(B) 0·5 μm
(C) 0·6 μm
(D) 0·7 μm

95. With respect to Earth's land surface, which of the following expressions is correct?

(A) Precipitation=Evaporation–Run off
(B) Precipitation=Run off–Evaporation
(C) Precipitation=Evaporation+Run off
(D) Precipitation=Evaporation*Run off

96. The last reversal of geomagnetic polarity occurred during the _____.

(A) Gilbert Chron
(B) Gauss Chron
(C) Matuyama Chron
(D) Brunhes Chron

97. The division between the zone of aeration and the zone of saturation is called the

(A) Interstitial zone
(B) Capillary fringe
(C) Belt of soil moisture
(D) Water table

98. Magnetometers are instruments used to measure the magnetic field. A type of magnetometer is the absorption-cell magnetometer, which is also referred to as the optically pumped magnetometer. It utilizes the _____ in vapours of alkali elements.

(A) Compton effect
(B) Doppler effect
(C) Raman effect
(D) Zeeman effect

99. Which of the following surface ocean current flows in southern atlantic ocean?

(A) Canary Current
(B) Oyashio Current
(C) Kurushio Current
(D) Benguela Current

100. Which among the following rocks has the highest apparent specific gravity?

(A) Granite
(B) Gabbro
(C) Sandstone
(D) Quartzite

Space for Rough Work