Test Booklet Code & Serial No.
प्रश्नपत्रिका कोड व क्रमांक

B

Paper-II

EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCE

Signature and Name of Invigilator

Seat No. ☐☐☐☐☐☐☐

1. (Signature) ....

(Name) ....

(In figures as in Admit Card)

2. (Signature) ....

Seat No. ....

(In words)

(Name) ....

OMR Sheet No. ☐☐☐☐☐☐☐

MAR - 35223

(To be filled by the Candidate)

Time Allowed : 2 Hours]

[Maximum Marks : 200

Number of Pages in this Booklet : **16**

Number of Questions in this Booklet : **100**

Instructions for the Candidates	**विद्यार्थ्यांसाठी महत्त्वाच्या सूचना**
1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.	1. परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोप-यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. This paper consists of **100** objective type questions. Each question will carry *two* marks. *All* questions of Paper II will be compulsory.	2. सदर प्रश्नपत्रिकेत 100 बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे.
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :	3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनिटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
(i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal or open booklet.	(i) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्वीकारू नये.
(ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to missing pages/questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.	(ii) पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चुकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटातच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी. त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळही वाढवून मिळणार नाही याची कृपया विद्यार्थ्यांनी नोंद घ्यावी.
(iii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.	(iii) वरीलप्रमाणे सर्व पडताळून पाहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
4. Each question has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item. **Example :** where (C) is the correct response. Ⓐ Ⓑ ● Ⓓ	4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यामधील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा/निळा करावा. **उदा. :** जर (C) हे योग्य उत्तर असेल तर. Ⓐ Ⓑ ● Ⓓ
5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only.** If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.	5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत.** इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6. Read instructions given inside carefully.	6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. Rough Work is to be done at the end of this booklet.	7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या कोऱ्या पानावरच कच्चे काम करावे.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.	8. जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणाव्यतिरिक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणतीही खूण केलेली आढळून आल्यास अथवा असभ्य भाषेचा वापर किंवा इतर गैरमार्गाचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र ठरविण्यात येईल.
9. You have to return 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 the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.	9. परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापि, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्यांना परवानगी आहे.
10. Use only Blue/Black Ball point pen.	10. फक्त निळ्या किंवा काळ्या बॉल पेनाचाच वापर करावा.
11. Use of any calculator or log table, etc., is prohibited.	11. कॅल्क्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12. There is no negative marking for incorrect answers.	12. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

Earth, Atmospheric, Ocean and Planetary Science
Paper II

Time Allowed : 120 Minutes]   **[Maximum Marks : 200**

Note : This Paper contains **Hundred (100)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

1. A single tone 5 kHz message signal is sampled with 12 kHz, 8 kHz and 5 kHz. "Aliasing" effect will be observed in the reconstructed signal, when the 5 kHz signal is sampled with :
   (A) 12 kHz
   (B) Both 12 kHz and 8 kHz
   (C) Both 8 kHz and 5 kHz
   (D) Aliasing will not be observed in any case

2. The segments of oceanic crust between island arcs and continents are termed :
   (A) Fore-arc basins
   (B) Island arc margins
   (C) Back-arc basins
   (D) Sea mounts

3. The stress regime at the mid-ocean ridges is tensional in character. This is supported by earthquakes due to :
   (A) Normal faulting
   (B) Strike-slip faulting
   (C) High angle reverse faulting
   (D) Opening of rift at the ridge crest

4. The focal mechanism solution of an earthquake depicts quadrants of :
   (A) Dilatation
   (B) Compression
   (C) Compression and dilatation
   (D) Amount of energy released

5. Evidence for the Earth's liquid outer core comes from the fact that :
   (A) S-waves do not travel through the core
   (B) A shadow zone for S-waves exists beyond 103° from the earthquakes focus
   (C) Both (A) and (B)
   (D) Neither (A) nor (B)

6. How many total number of pixel values will a 8-bits satellite image have ?
   (A) 64   (B) 128
   (C) 256   (D) 7856

7. The 'boundary model' is sometimes also called as :
   (A) Topological data model
   (B) Temporal data model
   (C) Topological discrete model
   (D) Temporal discrete model

8. In the process of image classification which of the following methods result in a greater accuracy of classes within an image actually matching land use patterns on the ground ?

    (A) Automated

    (B) Unsupervised

    (C) Supervised

    (D) Robotic

9. Satellite data stores pixel information band by band for each line, or row, of the image is .... data format.

    (A) BIL   (B) BIP

    (C) BSQ   (D) BQR

10. Which of the following is small scale Aerial photo ?

    (A) 1 : 10000   (B) 1 : 25000

    (C) 1 : 50000   (D) 1 : 250000

11. What is the wavelength of ultraviolet spectrum ?

    (A) 0.3 to 0.4 micrometer

    (B) 1 to 300 millimeter

    (C) 0.4 to 0.7 micrometer

    (D) > 300 centimeter

12. Which of the following statements are *correct* with respect to transportation of matter by stream ?

    (*i*) Dissolved matter is transported in the form of chemical ions

    (*ii*) Sand, gravel and larger particles move as bed load

    (*iii*) Clay and silt are carried as suspended load

    (*iv*) Generally, the bed load is the largest

    Codes :

    (A) (*i*) and (*ii*) only

    (B) (*ii*) and (*iii*) only

    (C) (*i*), (*ii*) and (*iii*) only

    (D) (*iii*) and (*iv*) only

13. Match the following :

    List–I (River)

    (*a*) Indus

    (*b*) Ganga

    (*c*) Brahmaputra

    (*d*) Cauvery

    List–II (Tributary)

    (*i*) Raga Zangbo

    (*ii*) Herangi

    (*iii*) Shiger

    (*iv*) Alaknanda

    Codes :

	(*a*)	(*b*)	(*c*)	(*d*)
(A)	(*iii*)	(*ii*)	(*i*)	(*iv*)
(B)	(*iii*)	(*iv*)	(*i*)	(*ii*)
(C)	(*ii*)	(*iv*)	(*iii*)	(*i*)
(D)	(*iii*)	(*i*)	(*ii*)	(*iv*)

14. Which one of the following statements is not *correct* about soils of Extra-Peninsular India ?

    (A) These soils are mainly found in river valleys and deltas

    (B) These soils have been formed by the decomposition of rock in situ

    (C) They are deep and constitute some of the most fertile tracts of the country

    (D) These soils are often referred to as transported or azonal soils

15. Amongst the listed ecosystems, which one has the highest net primary production ?

    (A) Estuaries (tidal)

    (B) Midlatitude forest

    (C) Midlatitude grassland

    (D) Lakes and streams

16. If the surface temperature of the air parcel is 30 degree Celsius and the moist adiabatic lapse rate 7 degree Celsius/km, what will be the temperature of the air parcel at 4 km altitude for a lifting condensation level of 2 km ?

    (A) –6 degree Celsius

    (B) –4 degree Celsius

    (C) 0 degree Celsius

    (D) 6 degree Celsius

17. Given below are two statements, Assertion (A) and Reason (R). Read the statements carefully and choose the correct answer from the codes given below :

    (A) Ozone is concentrated in stratosphere at the height of about 30 km.

    (R) At 30 km height in the atmosphere there is enough microwave radiation necessary to produce atomic hydrogen.

    Codes :

    (A) Both (A) and (R) are true and (R) is the correct explanation of (A)

    (B) Both (A) and (R) are true and (R) is not the correct explanation of (A)

    (C) (A) is true but (R) is false

    (D) (A) is false but (R) is true

18. Given below are two statements Assertion (A) and Reason (R). Read the statements carefully and choose the correct codes from those given below :

    (A) Raised shorelines are common along the continental and island coasts of Pacific Ocean.

    (R) In these regions tectonic processes are active along the mountain and island arcs.

    Codes :

    (A) Both (A) and (R) are true and (R) is the correct explanation of (A)

    (B) Both (A) and (R) are true and (R) is not the correct explanation of (A)

    (C) (A) is true but (R) is false

    (D) (A) is false but (R) is true

19. Where the shoreline is straight for many kilometers littoral drift moves the sand along the beach resulting in the formation of :
(A) Pocket beach
(B) Sandspit
(C) Abrasion platform
(D) Stack

20. Which one of the following schist belt *does not* belong to Dharwar craton ?
(A) Shimoga schist belt
(B) Nuggihalli schist belt
(C) Gangpur schist belt
(D) Sargur schist belt

21. Which of the following schist belt is the youngest ?
(A) Dharwar
(B) Sargur
(C) Wynad
(D) Sathyamangalam

22. Global scale events at ~1.8 Ga and 0.9 Ga refer to :
(A) Amalgamation of supercontinents Columbia and Rodinia
(B) Amalgamation of supercontinent Columbia and fragmentation of Rodinia
(C) Fragmentation of supercontinents Columbia and Rodinia
(D) Fragmentation of supercontinent Columbia and amalgamation of Rodinia

23. Which of the following is *not* true for Komatiites ?
(A) They are associated with greenstone belts
(B) They are of Archaean age
(C) They are ultramafic lavas
(D) They are characterized by ophitic texture

24. An .... is a layer or layered sequence of rock or sediment comprising one or more geological formations that contains water and is able to transmit significant quantities of water under an ordinary hydraulic gradient.
(A) Aquitard
(B) Aquiclude
(C) Aquifer
(D) Aquifuge

25. In which zone groundwater fills all the interstices ?
(A) Capillary zone
(B) Soil zone
(C) Vadoze zone
(D) Zone of saturation

26. What is the residence time of water in Atmosphere ?
(A) 20 days
(B) 30 days
(C) 9 days
(D) 50 days

27. A detension basin for flood control is the one which is provided with :
(A) Uncontrolled outlet and spillway
(B) Uncontrolled outlet but uncontrolled spillway
(C) Controlled outlet but uncontrolled spillway
(D) Controlled outlet and spillway

28. Intensity of an earthquake is measured by :
(A) Seismograph
(B) Richter scale
(C) Modified Mercalli scale
(D) Derivatograph

29. Read the following statements and choose the *correct* answer from the codes given below :
   (*i*) The movement of mineral nutrients in an ecosystem is unidirectional in nature
   (*ii*) The movement of energy in an ecosystem is cyclic in nature
   Codes :
   (A) Both (*i*) and (*ii*) are true
   (B) Both (*i*) and (*ii*) are false
   (C) (*i*) is true but (*ii*) is false
   (D) (*i*) is false but (*ii*) is true

30. Placers formed upon hill slopes or along the foot hills from minerals released from a nearby source rock are called :
   (A) Alluvial placers
   (B) Eluvial placers
   (C) Beach placers
   (D) Aeolian placers

31. Nickel-Copper sulphide deposits of Insizwa, South Africa and Sudbury, Ontario, Canada are the examples of :
   (A) Early magmatic dissemination
   (B) Early magmatic segregation
   (C) Residual liquid segregation
   (D) Immiscible liquid segregation

32. Volcanic hosted massive sulphide (VMS) deposits mostly associated with felsic volcanic rocks are called as :
   (A) Kuroko-type (B) Besshi-type
   (C) Cyprus-type (D) Noranda-type

33. Porphyry copper deposits are associated with
   (A) Mid-oceanic ridges
   (B) Subduction zones
   (C) Continental rifts
   (D) Back arc basins

34. Which one of the following is an ore of platinum group of elements (PGE) ?
   (A) Sperrylite   (B) Digenite
   (C) Dioptase   (D) Bornite

35. Commercial banded iron formations of India are mostly of :
   (A) Palaeozoic age
   (B) Mesozoic age
   (C) Proterozoic and Archaean age
   (D) Cenozoic age

36. Match the following :
   I
   (1) Cumulus texture
   (2) Exsolution texture
   (3) Caries texture
   (4) Cockade texture
   II
   (*i*) Banding and crustification in open space
   (*ii*) Protuberances of replacing minerals with replaced host
   (*iii*) Spindles or lamellae of one mineral in another
   (*iv*) Aggregates of minerals with non-penetrative mineral boundaries
   Codes :
 | | (1) | (2) | (3) | (4) |
   |-----|--------|---------|--------|--------|
   | (A) | (*iv*) | (*iii*) | (*ii*) | (*i*) |
   | (B) | (*iii*)| (*iv*) | (*ii*) | (*i*) |
   | (C) | (*ii*) | (*iii*) | (*i*) | (*iv*) |
   | (D) | (*iii*)| (*ii*) | (*i*) | (*iv*) |

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37. Which of the following is the best mineral for fluid inclusion thermometry ?
    (A) Chalcopyrite (B) Magnetite
    (C) Wolframite (D) Quartz

38. Which of the following states of India is the largest producer of Lignite ?
    (A) Gujarat   (B) Tamil Nadu
    (C) Rajasthan   (D) Assam

39. Copper in a calcareous environment is :
    (A) Mobile
    (B) Immobile
    (C) Sometimes mobile and sometimes immobile
    (D) Partially mobile

40. Saturation vapour pressure in air :
    (A) Increases linearly with temperature
    (B) Increases non-linearly with temperature
    (C) Decreases linearly with temperature
    (D) Decreases non-linearly with temperature

41. A significant proportion of solar rays cannot penetrate in the Ocean upon depth of :
    (A) 50 m   (B) 15 m
    (C) 20 m   (D) 200 m

42. Which of the following statements is/are true for the major principal layers of oceanic water ?
    (i)   a thin upper layer of warm, well-stirred water
    (ii) a thick mass of deeper, colder water that is relatively calm and slow-moving
    (iii) a thick upper layer of warm well-stirred water
    (iv) a thin mass of deeper, colder water which is well-stirred water
    (A) (ii) and (iii)
    (B) (i) and (ii)
    (C) (i) and (iii)
    (D) (ii) and (iv)

43. About how much concentration of dissolved salt (NaCl) present in the open ocean ?
    (A) 10 g of dissolved salt per kg of water
    (B) 20 g of dissolved salt per kg of water
    (C) 30 g of dissolved salt per kg of water
    (D) More than 100 g of dissolved salt per kg of water

44. What should be the height of the submarine volcanic mountain to be called as seamount ?
    (A) Minimum 1000 m
    (B) Between 1000 m – 500 m
    (C) Between 100 m – 500 m
    (D) Less than 100 m

45. Which of the following given statements is/are correct ?

   (*i*) Exclusive economic zone extent seaward upto 200 nautical miles from the baseline

   (*ii*) Contiguous zone extends seaward upto 24 nautical miles from the baselines

   (*iii*) Territorial sea extend seaward upto 10 nautical miles from the baseline

   (A) (*i*) and (*iii*)

   (B) (*i*) and (*ii*)

   (C) (*ii*) and (*iii*)

   (D) (*i*), (*ii*) and (*iii*)

46. What is the spreading rate of slow spreading ridge ?

   (A) 8-16 cm/year

   (B) 40-80 mm/year

   (C) 10-40 mm/year

   (D) 16-24 cm/year

47. Adding .... to lime or cement reduces swelling and improve engineering properties of expansive soils.

   (A) Bitumen   (B) Anhydrite

   (C) Bauxite   (D) Fly ash

48. The ground beneath a large lake consists of a 50 m thick deposit of clay with a rock substratum. The bed of the lake is flat and 20 m depth. The action of geological processes generates clay in suspension which in a very short time form a 2 m thick layer of sediments that completely covers the bottom of the lake.

   Assuming the free water surface remains unchanged, determine the total vertical stress in the original situation.

   Given : The saturated unit weight of the clay is constant and equal to r_{sat} = 20 kN/m^3.

   The unit weight of water is
   $$r_w = 10 \text{ kN/m}^3.$$

   The rock substratum is impervious for practical purpose. The surface of the water in the lake is taken as the origin of the depth axis z.

   (A) 400 kPa   (B) 810 kPa

   (C) 1200 kPa   (D) 1600 kPa

49. Clay with .... of iron oxides when burnt produces brick of buff colour.

   (A) 2 to 3%   (B) 3 to 6%

   (C) 6 to 8%   (D) 8 to 12%

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50. Features given below are diagnostic to which sedimentary environment ?
Tectonic setting : Formed in very deep water basin, trench, along ophiolites, epicratonic basins or as starved of clastic debris, accumulated thick sequences of chalk, cherts or black shales.
Geometry : Form vast, thin, tabular sheets, in fault--bounded basins it can reach thousands of meters in thickness
Typical sequence : Homogeneous, thin bedded, laminated chalk, chert or shales.
Sedimentology : Chalks, opaline silica, clay minerals are predominant, Minor authigenic minerals, volcanic and eolian dust, phosphatic fragment. Extensive bioturbation and burrowing.
Fossils : Planktonic microfossil, siliceous or phosphatic microfossils.
(A) Tidal
(B) Pelagic
(C) Continental shelf
(D) Deltas

51. A galena grain of diameter 0.5 mm falls in water with a settling velocity of 8.27 in/s. Calculate the Froude Numbers for the galena grain.
P_s = 7.5 g/cm^3
g = 981 cm/sec^2
P_f = 1 g/cm^3
μ = 0.01 g cm^{-1} sec^{-1}
(A) 6.99 (B) 7.09
(C) 8.99 (D) 6.01

52. Using Stokes equation for settling velocity estimate the maximum diameter of silica grain that exhibit laminar flow in water at 20ºC assuming that silica grain Reynolds' number is < 1.
Given :
Density of silica = 2.65 g/cm^3
Density of water = 1.0 g/cm^3
Viscosity of water = 0.01 g/cm/sec
Acceleration due to gravity = 981 cm/sec^2
(A) 103.2 μm (B) 204.1 μm
(C) 402.1 μm (D) 322 μm

53. A rock with < 1 mm separation in the joint gouge with 4 rating is termed as ...., that can be excavated with very hard ripping as per the Rippability Chart of Weaver (1975).
(A) Very good rock
(B) Good rock
(C) Fair rock
(D) Poor rock

54. The marine isotope stage 5 problem refers to the timing of penultimate interglacial which appears to have begun 10 thousand years in advance of :
(A) Younger Dryas
(B) Last interglacial
(C) Last glaciation
(D) Solar forcing

55. The little Ice Age cold event during Holocene was abruptly followed by :
(A) Holocene cooling
(B) Mesopotemia
(C) Medieval Warming
(D) Younger Dryas

56. The final closure of the seaway between North and South Americas may have laid to strengthening of the Gulf stream delivering more moisture to feed snow accumulation at the northern high latitude leading to :
    (A) Ice Age
    (B) Interglacial Warming
    (C) Cooling of Pacific
    (D) Heating of Indian Ocean

57. Mark the correct order of stages from older to younger during the Holocene period :
    (A) Boreal–Pre-Boreal–Subboreal
    (B) Subatlantic–Atlantic–Subboreal
    (C) Boreal–Atlantic–Subboreal
    (D) Subatlantic–Subboreal–Preatlantic

58. The negative Bouger anomaly across the Mid-Oceanic ridges is due to :
    (A) Ridge Topography
    (B) Hot mantle convergence
    (C) Hot mantle surrounded by cold mantle
    (D) Ridge push mechanism

59. The Yilgarn shield and Pilbara shield comprises significant part of the older cratonic shields of the continent :
    (A) Australia
    (B) Africa
    (C) South America
    (D) Canada

60. The heights and widths of the mid-oceanic ridges with reference to the abyssal plane is of the order :
    (A) 6 km and 1500 km, respectively
    (B) 2.5 km and 3000 km, respectively
    (C) 3 km and 500 km, respectively
    (D) 3000 km and 1000 km, respectively

61. The heat flux in the 'X' direction (9X) is proportional to the magnitude of temperature change across a unit distance in 'X' direction. If 'K' is thermal conductivity of the material, then the heat flux can be expressed as :
    (A) $9X = (dT/dx)/K$
    (B) $9X = -K(dT/dx)$
    (C) $9X = (dT/dx)$
    (D) $9x = dT(dx/K)$

62. A fold with interlimb angle of zero is :
    (A) Gentle   (B) Open
    (C) Tight   (D) Isoclinal

63. Identify the Ramsay fold type :
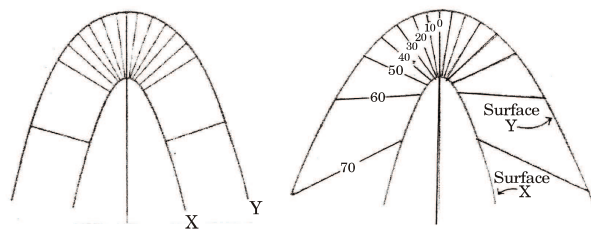
    (A) Class 1A and Class 2
    (B) Class 1B and Class 2
    (C) Class 1C and Class 1A
    (D) Class 1A and Class 1B

[P.T.O.

64. Vertical faults have throw but do not have ....
    (A) Heave   (B) Strike slip
    (C) Dip slip   (D) Rake

65. In an S-tectonite the strain ellipsoid will be :
    (A) Prolate finite strain
    (B) Plane strain
    (C) Oblate finite strain
    (D) Infinite plane strain

66. A rock having composition- Nepheline-olivine-clinopyroxene-plagioclase known as :
    (A) Tephrites   (B) Basanite
    (C) Troctolite   (D) Olivinenorite

67. The reaction : Tremolite + Calcite + Quartz = Diopside + H_2O + CO_2 is a :
    (A) Net-Transfer reaction
    (B) Mixed volatile reaction
    (C) Both (A) and (B)
    (D) Exchange reaction

68. The presence of galucophane and jadeite indicate :
    (A) High pressure and low temperature
    (B) Low pressure and high temperature
    (C) Low pressure and low temperature
    (D) High pressure and high temperature

69. The snowball garnet are the product of :
    (A) Dynamic metamorphism
    (B) Cataclastic metamorphism
    (C) Dynamothermal metamorphism
    (D) Plutonic metamorphism

70. The characteristic of common orogenic belts (Barrovian type), where the sequence is Zeolite facies → Prehnite-pumpellite facies → Greenschist facies → Amphibolite facies → Granulite facies are formed represent the metamorphic series :
    (A) Medium P/T series
    (B) High P/T series
    (C) Both (A) and (B)
    (D) Low P/T series

71. The process by which a solid melts to a liquid and another solid, both of different composition than the original is known as :
    (A) Congruent melting
    (B) Incongruent melting
    (C) Eutectic melting
    (D) Equilibrium melting

72. If the groundmass of a porphyritic texture in a rock is hemicrystalline, the texture is known as :
    (A) Vitrophyric
    (B) Felsophyric
    (C) Glomerophyritic
    (D) Mesostasis

73. Which of the following rocks is dominantly composed of clinopyroxene and garnet, mafic in bulk composition and equilibrated under high pressure and low geothermal gradient conditions in the lithospheric mantle ?
    (A) Eclogite   (B) Tinguaite
    (C) Pyroxenite   (D) Alkali Basalt

74. This trace element is mostly concentrated in the crust and substitute for a major element in feldspar, muscovite, biotite and sodic plagioclase.
(A) Nickel   (B) Neodymium
(C) Rubidium   (D) Calcium

75. Consider the following statements :
Statement–1 : The ratio of Ni : Mg is highest in early formed crystals like olivine and shows a steady decline in late formed minerals.
Statement–2 : The nickel ion has essentially the same radius as magnesium.
Which of the following is *correct* with respect to the above statements ?
Codes :
(A) Both statement–1 and statement-2 are true and statement-1 is the correct explanation of statement-2
(B) Both statement-1 and statement-2 are true and statement-1 is not the correct explaination of statement-2
(C) Statement-1 is true but statement-2 is false
(D) Statement-1 is false but statement-2 is true

76. $^{206}Pb/^{238}U$ versus $^{207}Pb/^{235}U$ ratios when plotted yield concordant ages, also indicate :
(A) Pb loss event
(B) Alteration event
(C) Loss or gain of radiogenic lead
(D) No loss or gain of radiogenic lead

77. Which of the following statements is true ?
(A) Oxidation of Mn (II) to Mn (IV) is required for manganese ore precipitation
(B) Reduction of Mn (IV) to Mn (II) is required for manganese ore precipitation
(C) Manganese ore precipitation is independent of redox conditions
(D) Both (A) and (B) are correct

78. Higher amounts of which of the following isotopes indicate plume related enriched mantle origin of early Deccan volcanic rocks.
(A) $^{87}Sr/^{86}Sr$
(B) $^{87}Rb/^{86}Rb$
(C) $^{3}He/^{4}He$
(D) $^{187}Os/^{188}Os$

79. Solid angle is an angle between at least :
(A) Two lines   (B) Three lines
(C) Two facies   (D) Three facies

80. Which of the following have curved crystal facies ?
(A) Hypersthene (B) Actinolite
(C) Siderite   (D) Lepidolite

81. The correct order of succession of supercontinent formation amongst the following is :
(A) Rodinia–Pangea–Gondwana
(B) Columbia–Arctica–Atlantica
(C) Columbia–Rodinia–Pannotia
(D) Columbia–Gondwana–Rodinia

82. The value of SAR is used in classifying the water for :
    (A) Domestic use
    (B) Irrigation use
    (C) Industrial use
    (D) (A) and (B)

83. Which stratigraphic unit of the paleozoic succession of Lidar Valley, Kashmir Basin is unfossiliferous ?
    (A) Hapatnar Group
    (B) Muth Formation
    (C) Zewan Formation
    (D) Fenestella shales

84. Which of the following is considered a good index fossil for the Mesozoic Biostratigraphy ?
    (A) Forominifera
    (B) Conodont
    (C) Ammonite
    (D) Echinoderm

85. The first appearance datum (FAD) of which fossil species demarcate the Cambrian-Ordovician boundary ?
    (A) FAD *Trichophycus pedum*
    (B) FAD *Oryctocephalus indicus*
    (C) FAD *Lapetognathus fluctivagus*
    (D) FAD *Tetragraptus approximates*

86. Trace fossil *Repichnia* indicate which strategy ?
    (A) Feeding   (B) Grazing
    (C) Locomotion (D) Escaping

87. Which sponge species has spicules composed of silicic acid ?
    (A) *Euplectella*   (B) *Sycon*
    (C) *Leucosolenia* (D) *Petrosoma*

88. The term 'coprolite' is applied to :
    (A) Fossil shell
    (B) Fossil excreta
    (C) Fossil traces
    (D) Fossil bones

89. Which of the following is *not* a body fossil ?
    (A) *Ptilophyllum*
    (B) *Neogloboquadrina*
    (C) *Valcourea*
    (D) *Ceratites*

90. Short range forecasting refers to forecasting the weather valid for :
    (A) 1 week to 2 weeks
    (B) 3 weeks to 4 weeks
    (C) 1 to 3 days
    (D) 4 to 5 days

91. The average electrical conductivity of the Earth is about :
    (A) 10 s/meter
    (B) 1 s/meter
    (C) 10^{-3} s/meter
    (D) 10^{-9} s/meter

92. Stationary front occurs when :
    (A) Surface position of a front moves so that warm air occupies territory formerly covered by cooler air
    (B) Cold continental polar air actively advances into a region occupied by warm air
    (C) An active cold front overtakes a warm front
    (D) Air flow on both sides of a front is neither towards the cold air mass nor towards the warm air mass

93. The Coriolis force at the equator is :
    (A) negative   (B) positive
    (C) infinite   (D) zero

94. The electric potential of the electrosphere is positive with respect to Earth and its magnitude is about :
    (A) 1000 kV   (B) 3000 kV
    (C) 300 kV   (D) 30 kV

95. In regions when there is a net outflow of air, a situation referred to as :
    (A) Convergence (B) Advection
    (C) Convection   (D) Divergence

96. The dominant mechanism of heat transfer in a hot spring is :
    (A) Radiation   (B) Convection
    (C) Conduction (D) Transmission

97. The three principal stresses S_v, S_H and S_h represent the magnitudes of vertical component of stress, maximum horizontal stress and minimum horizontal stress. According to Anderson's faulting theory, a strike-slip fault movement may be inferred if :
    (A) $S_H > S_h > S_v$
    (B) $S_h > S_H > S_v$
    (C) $S_H > S_v > S_h$
    (D) $S_v > S_H > S_h$

98. The half-life of radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80% of the ^{14}C found in a living tree. The estimated age of the artifact would be :
    (A) 3208 years   (B) 5730 years
    (C) 1846 years   (D) 2303 years

99. Which of the following statements is *correct* ?
    (*i*) Seismic reflection method depends on acoustic impedance contrast
    (*ii*) Gravity method is sensitive to lateral density variations
    (*iii*) Magnetic method is sensitive to susceptibility contrast
    (*iv*) Electrical method depends on electrical resistivity variations
    (A) Only (*i*) is correct
    (B) Only (*ii*) and (*iii*) are correct
    (C) Only (*iv*) is correct
    (D) (*i*), (*ii*), (*iii*) and (*iv*) are correct

100. A cross-plot between which two well logs show "football" effect/presence of free gas ?
    (A) Neutron-Sonic
    (B) Neutron-density
    (C) Density-Sonic
    (D) NMR-Neutron

ROUGH WORK