



## Paper – II

### Earth, Atmosphere, Ocean and Planetary Sciences

Booklet Code

A

TEST BOOKLET NO.

Subject Code :

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Roll No. :

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(Figures as per admission card)

Roll No. (in words) :

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OMR Sheet No. :

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#### Name and Signature of Invigilator/s

Signature : \_\_\_\_\_

Name : \_\_\_\_\_

Time : 2 Hours

Maximum Marks : 200

Number of Pages in this Booklet : 20

Number of Questions in this Booklet : 100

#### Instructions for the Candidates

- Write your roll number in the space provided on the top of this page.
- This paper consists of hundred (100) multiple-choice type of questions.
- At the commencement of examination, the test booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below** :
  - To have access to the Test Booklet, tear off the paper seal on the edge of the cover page. Do not accept a booklet without sticker seal or open booklet.
  - Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Test Booklet will be replaced nor any extra time will be given.**
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- Each item 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 :** (A) (B) ● (D)  
 where (C) is the correct response.
- Your responses to the questions are to be indicated in the **OMR Sheet kept inside this Booklet**. If you mark at any place other than in the circles, the OMR Sheet will not be evaluated.
- Read the instructions given in OMR Sheet carefully. Fill the Booklet Code of Paper – II in OMR Sheet **Compulsorily**.
- Rough Work is to be done in the end of this booklet.
- If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space provided for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
- You have to return the OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
- You can take away test booklet and carbon copy of OMR Answer Sheet after the examination.
- Use only Blue/Black Ball point pen.**
- Use of any calculator, electronic gadgets or log table, etc. is prohibited.**
- There is no negative mark for incorrect answer.**



**EARTH, ATMOSPHERE, OCEAN AND PLANETARY SCIENCES**  
**Paper – II**

1. The curvature of the *biaxial isogyres* is expressions of
  - (A) Refractive indices
  - (B) Isotropism
  - (C) Angle between the optic axes i.e.,  $2V$
  - (D) Anisotropism
2. The enstatite exhibits two sets of cleavage in the basal section (110) typically at angles of
  - (A)  $90^\circ$  and  $90^\circ$
  - (B)  $54^\circ$  and  $126^\circ$
  - (C)  $56^\circ$  and  $124^\circ$
  - (D)  $88^\circ$  and  $92^\circ$
3. Which one of the following minerals belongs to *pseudoisometric* crystal system ?
  - (A) Leucite
  - (B) Nepheline
  - (C) Cancrinite
  - (D) Melilite
4. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :

**Assertion (A)** : Microcline gives quadrille structure, the two sets of lamellae being at right angle.

**Reason (R)** : Polysynthetic twinning is shown in two directions, one according to the albite law and another according to the pericline law.

  - (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
  - (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
  - (C) (A) is false, but (R) is true
  - (D) (A) is true, but (R) is false
5. The labradorite variety of plagioclase feldspar has range of anorthite (An) content between
  - (A)  $An_{10}$  and  $An_{30}$
  - (B)  $An_{30}$  and  $An_{50}$
  - (C)  $An_{50}$  and  $An_{70}$
  - (D)  $An_{70}$  and  $An_{90}$
6. Which is the fundamental unit of lithostratigraphic classification ?
  - (A) Zone
  - (B) Formation
  - (C) Member
  - (D) Bed
7. The characteristic fossils of Subathu Formation are \_\_\_\_\_
  - (A) *Bucella frigida*
  - (B) *Globorotalia truncata*
  - (C) *Nummulites atacicus*
  - (D) *Assilina ammonica*
8. The species *Homo Sapiens sapiens* evolved around
  - (A) 200 thousand years ago to present
  - (B) 200 to 300 thousand years ago
  - (C) 400 million year ago
  - (D) 4 million year ago



9. Which one of the following sedimentary basins is not associated with divergent plate movement ?

- (A) Down wrap
- (B) Rift
- (C) Interior
- (D) Foreland

10. Match the following :

Formation	Vertebrate fossils
-----------	--------------------

- |                    |                     |
|--------------------|---------------------|
| I. Upper Siwalik   | 1. Mastodon         |
| II. Middle Siwalik | 2. Tetrabelodon     |
| III. Lower Siwalik | 3. Australopithecus |
|                    | 4. Equus            |

I   II   III

- (A) 1   2   4
- (B) 4   1   2
- (C) 3   1   4
- (D) 4   3   2

11. During Ice age, when the Sea-level was lower, North America and Asia were connected by dry land today exist the

- (A) Tasmania strait
- (B) Bering strait
- (C) Sunda strait
- (D) Palk strait

12. Match the following :

Name of Winds	Wind Characteristics
a. Chinook winds	1. Bring bitterly cold conditions
b. Polar Easterlies	2. Most regular and constant
c. Trade winds	3. Snow Eaters
d. Westerlies	4. Stormy and powerful in Southern Hemisphere

	a	b	c	d
(A)	4	1	2	3
(B)	3	1	4	2
(C)	1	3	2	4
(D)	3	1	2	4

13. Carbonatites in which carbonate fraction is more than 90% dolomite, are known as

- (A) Calcite-dolomite carbonatite
- (B) Boforsite
- (C) Dolomite-calcite carbonatite
- (D) Natrocarbonatite

14. What would be whole rock silica content of a rock which contains 30 volume % quartz and 70 volume % plagioclase with 60 wt.% of silica ?

- (A) 52 wt.%
- (B) 62 wt.%
- (C) 72 wt.%
- (D) 82 wt.%



15. A plutonic igneous rock which contains equal amount of modal quartz and plagioclase but K-feldspar less than 5 volume %, can be more appropriately named as  
(A) Quartz diorite (B) Tonalite  
(C) Granodiorite (D) Monzogranite
16. Which of the following sedimentary structures can be used as unidirectional palaeocurrent indicators ?  
i. Current crescent  
ii. Symmetrical ripples  
iii. Asymmetrical ripples  
iv. Imbrications  
(A) i, ii and iii (B) i, iii and iv  
(C) i, ii and iv (D) ii, iii and iv
17. An unsorted mixture of clay and boulders known as \_\_\_\_\_ is an example of ice-deposited sedimentary rock.  
(A) Boulder clay (B) Till  
(C) Illite (D) Moraine
18. The matrix of Packstone is \_\_\_\_\_  
(A) Clay  
(B) Silt  
(C) Mud  
(D) Sand
19. Herringbone structure is generally formed in which of the following environments ?  
(A) Fluvial (B) Lacustrine  
(C) Aeolian (D) Tidal
20. Identify the mountain system formed due to collision of continental plates.  
1. Himalayas  
2. The Alps  
3. The Rockies  
4. The Caucasus mountains  
Select the correct answer using the codes given below :  
(A) 1, 2 and 3 (B) 2, 3 and 4  
(C) 1, 2 and 4 (D) 1, 3 and 4
21. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :  
**Assertion (A)** : Magnitude of an earthquake does not vary from place to place.  
**Reason (R)** : Magnitude is a function of energy released in an earthquake.  
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)  
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)  
(C) (A) is true, but (R) is false  
(D) (A) is false, but (R) is true
22. Ore stage material, either in the form of visual minerals or of trace elements that must be determined chemically, may be dispersed in the massive rocks and in fracture zones over blind redeposits are called  
(A) Epigenetic minerals  
(B) Leakage  
(C) Wall rock anomaly  
(D) Hydrothermal dispersion



23. *Astragalous declinatus* is a plant indicator for

- (A) Molybdenum (B) Silver  
(C) Copper (D) Gold

24. Match the following lithological association with their representative deposit :

Lithological association	Type of deposit
P. Volcanic intercalated with greywacke turbidites sequence	I. Mississippi Valley Type Pb-Zn deposit
Q. Platformal carbonate rocks	II. Stratiform type of Chromite deposit
R. Thick clastic sequence with diamictites	III. Algoma type BIF deposit
S. Dunite-peridotite-hurzburgite	IV. Reptian type Iron deposits

- (A) P-I, Q-IV, R-III, S-II  
(B) P-II, Q-IV, R-III, S-I  
(C) P-III, Q-I, R-IV, S-II  
(D) P-IV, Q-I, R-III, S-II

25. Carbonate melts can be rich in  
(A) Fe, Ti, Cr, V (B) Nb, Ta, REEs  
(C) Ni, Cu, PGE (D) Sn, W

26. Consider the following statement related to the fundamental concepts of geomorphology discussed by Thornbury :

- As the different erosional agents act upon the earth's surface they produced an orderly sequence of landforms.
- A geomorphic cycle starts with the law of initial horizontality.
- Complexity of geomorphic evolution is more common than simplicity.
- Little of the earth's topography is older than Tertiary and most of it no older than Pleistocene.

Choose the correct answer from the codes given below :

- (A) i and ii are correct  
(B) ii, iii and iv are correct  
(C) i, ii and iii are correct  
(D) i, iii and iv are correct

27. In India, tidal bores are common in the river

- (A) Ganga (B) Yamuna  
(C) Godavari (D) Hooghly

28. Which of the following statement is/are false ?

P – Creep is a type of rock fall.

Q – Creep is a very slow movement of slope material.

- (A) Only P (B) Only Q  
(C) Both P and Q (D) Neither P nor Q



29. Match the two Lists and choose the correct answer from the code given below the Lists :

**List – I**

**List – II**

**Type of mass movements      Nature of mass movements**

- |                      |  |
|----------------------|--|
| a. Rock Fall         | i. Rolling of rocks along with soil  |
| b. Rotational slide  | ii. Slip of unconsolidated material along curvilinear surfaces               |
| c. Debris Avalanches | iii. Sudden collapse of large mass of earth material due to earthquakes      |
| d. Solifluction      | iv. Soil saturated with long standing water slipping along frozen subsurface |
|                      | v. Rock slabs sliding along joint surfaces and bedding planes                |
|                      | vi. Ground subsidence in oil fields due to removal of oil and gas            |

- |     | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|-----|----------|----------|----------|----------|
| (A) | i        | ii       | iii      | iv       |
| (B) | v        | iii      | ii       | vi       |
| (C) | ii       | vi       | iii      | iv       |
| (D) | i        | iv       | iii      | v        |

30. In the Rock Mass Rating System (RMRS) proposed by Bieniawski, which one of the following is not a parameter ?

- (A) Rock Quality Designation (RQD)
- (B) Strike and dip of the joints
- (C) Unconfined Compressive Strength (UCS)
- (D) Lithological composition of the rocks

31. One of the plate of the apical disc in an Echinoid shell is perforated, this plate is known as

- (A) Ocular plate
- (B) Genital plate
- (C) Med reproach plate
- (D) Ambulacra plate

32. Cranidium is a region between \_\_\_\_\_

- (A) Fixed cheek and glabella
- (B) Free cheeks and fixed cheeks
- (C) Free cheek and glabella
- (D) Cephalon and thorax

33. Consider the following statements :

1. Globigerina ooze is a calcareous pelagic deposit.
2. Globigerina ooze is found mostly in the tropical and temperature zones of the Atlantic Ocean.

Which of the statements given above is /are correct ?

- (A) 1 only
- (B) 2 only
- (C) Both 1 and 2
- (D) Neither 1 nor 2



34. Mesozoic flora is dominated by \_\_\_\_\_ plants.
- (A) Angiosperm
  - (B) Gymnosperm
  - (C) Algae type
  - (D) Moss type
35. The age of Mammals is
- (A) Cenozoic Era
  - (B) Mesozoic Era
  - (C) Paleozoic Era
  - (D) Proterozoic Era
36. Degree of freedom (F) at cotectic is
- (A) 0                      (B) 1
  - (C) 2                      (D) 3
37. An isograd represents
- (A) An equilibrium reaction surface
  - (B) Disequilibrium reaction surface
  - (C) High enthalpy surface
  - (D) High entropy surface
38. Which of the following order of Rare Earth Elements (REE) is correct with increasing degree of incompatibility ?
- (A) La, Ce, Pr, Nd, Sm, Dy, Tm, Yb, Lu
  - (B) Lu, Yb, Tm, Dy, Sm, Nd, Pr, Ce, La
  - (C) La, Dy, Ce, Nd, Lu, Sm, Yb, Tm, Pr
  - (D) La, Ce, Pr, Nd, Sm, Dy, Tm, Y, Lu
39. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :
- Assertion (A)** : In nature melting of source rock is always partial.
- Reason (R)** : The Partial melting of upper mantle rock produces basalt.
- (A) (A) is false, but (R) is true
  - (B) (A) is true, but (R) is false
  - (C) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
  - (D) Both (A) and (R) are true and (R) is the correct explanation of (A)
40. If the olivine crystallizes from a mafic magma, the core of the olivine will be
- (A) Fayalite rich
  - (B) Forsterite rich
  - (C) Chromium rich
  - (D) Iron rich
41. Which among the following is characteristic of aulacogens ?
- (A) They are Palaeozoic rift valleys
  - (B) They are highly deformed regions representing oceanic trench
  - (C) They are rifts that rest at high angles to the adjacent orogenic belt
  - (D) They are narrow ridges formed over a plateau



42. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :

**Assertion (A)** : Trench-Suction force tends to draw the overriding plate towards the trench.

**Reason (R)** : As the slab sinks, it tends to pull the surficial part of the plate behind it.

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
- (C) (A) is true, but (R) is false
- (D) (A) is false, but (R) is true

43. The fold belt constrained within the Son-Narmada-North-Fault and Son-Narmada-South-Fault is

- (A) Lower Vindhyan Fold Belt
- (B) Mahakoshal Fold Belt
- (C) Satpura Fold Belt
- (D) Dongargarh Fold Belt

44. Match the two Lists and choose the correct answer from the codes given below the Lists:

List – I		List – II	
<b>Plate Margin Style</b>		<b>Modern Example Observed at</b>	
a. Passive		i. California	
b. Convergent		ii. Hawaii	
c. Transform		iii. Atlantic	
d. Back Arc		iv. Galapagos	
		v. Andes	
		vi. Japan sea	
<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
(A) ii	i	iii	vi
(B) iii	v	i	ii
(C) iv	vi	ii	i
(D) iii	v	i	vi

45. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :

**Assertion (A)** : The oldest rocks on passive continental margins are continental rift assemblages.

**Reason (R)** : A Wilson Cycle begins with the rupture of a continent along a rift system.

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
- (C) (A) is true, but (R) is false
- (D) (A) is false, but (R) is true

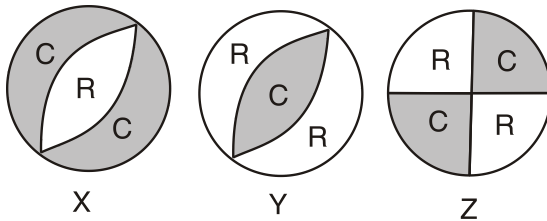




46. Which one of the following is mainly responsible for the formation of red tide ?

- (A) Coccoliths
- (B) Dinoflagellates
- (C) Radiolaria
- (D) Foraminifera

47. Consider the characteristics patterns of compression (C) and rarefaction (R) shown in the following figures. Match the two Lists and choose the correct answer from the codes given below the lists :



**List – I**

**List – II**

**Figure No.**

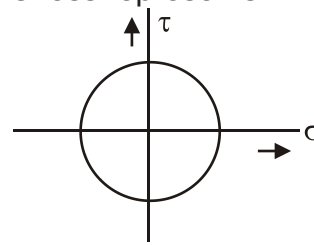
**Type of fault**

- |      |                      |
|------|----------------------|
| a. X | i. Strike-slip fault |
| b. Y | ii. Strike-fault     |
| c. Z | iii. Normal fault    |
|      | iv. Thrust fault     |
|      | v. Dip-slip fault    |
|      | vi. Dip fault        |

**Codes :**

- |     |          |          |          |
|-----|----------|----------|----------|
|     | <b>a</b> | <b>b</b> | <b>c</b> |
| (A) | ii       | i        | v        |
| (B) | ii       | vi       | i        |
| (C) | iii      | vi       | ii       |
| (D) | iii      | iv       | i        |

48. The given diagram of Mohr circle for stress represents



- (A) Overall compression
- (B) Overall tension
- (C) Pure shear
- (D) Hydrostatic state

49. Many times the ore body is present as filling of void that opened up during folding. Such filled-in features are called

- (A) Saddle reefs
- (B) Stock works
- (C) Discordant bodies
- (D) Caldera

50. The uranium deposits of Singbhum are associated with granitoids in the Singbhum shear zone. Which type of control of ore localization they show ?

- (A) Structural
- (B) Stratigraphic
- (C) Physico-chemical
- (D) All of them



51. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :  
**Assertion (A)** : Most wide dykes generally dip steeply provided they have not later been folded.  
**Reason (R)** : The basaltic magma which crystallizes to a slightly coarser grain size than in lava flows, is called diabase or dolerite.
- (A) (A) is false, but (R) is true  
(B) (A) is true, but (R) is false  
(C) Both (A) and (R) are true and (R) is correct explanation of (A)  
(D) Both (A) and (R) are true, but (R) is not correct explanation of (A)
52. Suspension of particles that are carried along by hot rising gases during a volcanic explosive activity with highly viscous magma produces
- (A) Air-fall deposits  
(B) Surge deposits  
(C) Ash-flow deposits  
(D) Air-fall tuff
53. In which tectonic environment, the depth of mantle from the surface of the Earth is minimal ?
- (A) Rift  
(B) Collisional  
(C) Subduction  
(D) Mid oceanic ridge
54. Consider the following statements regarding the distribution and pattern of isotherms :
1. In the northern hemisphere, isotherms bend sharply equatorward over the continents during winter.
  2. Temperature gradients are greater in summer than in winter in the northern hemisphere.
- Which of the statements given above is/are correct ?
- (A) 1 only                      (B) 2 only  
(C) Both 1 and 2              (D) Neither 1 nor 2
55. Consider the following :
1. Gulf of California
  2. Mediterranean Sea
  3. Baltic Sea
- In terms of decreasing salinity, which one of the following is the correct sequence ?
- (A) 1-2-3                      (B) 2-1-3  
(C) 3-1-2                      (D) 2-3-1
56. Regional metamorphism of pelitic rocks during orogenesis produces typical mineral sequence as index minerals
- (A) Chlorite-Garnet-Staurolite-Andalusite-Kyanite  
(B) Cordierite-Andalusite-Sillimanite-Chlorite-Biotite-Garnet  
(C) Chlorite-Biotite-Garnet-Staurolite-Kyanite-Sillimanite  
(D) Corundum-Kyanite-Andalusite-Sillimanite-Orthoclase



57. Coesite is formed under  
(A) Ultra-high-temperature metamorphism  
(B) Ultra-high-pressure-metamorphism  
(C) Low grade regional metamorphism  
(D) High grade regional metamorphism
58. A petrogenetic grid is a  
(A) Network of isopleth in the Pressure (P)-Temperature (T) section  
(B) Network of isothermal reaction only  
(C) Network of isobaric section only  
(D) Network of equilibrium curves in a P-T section
59. In migmatite, melanosome commonly formed due to  
(A) Crystallization of felsic minerals  
(B) Later intruded leucocratic melt  
(C) Squeezed out newly formed melt  
(D) Accumulation of residual minerals
60. The whole rock initial strontium isotopic ratio ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) of a cogenetic rock suite indicates  
(A) Isochrone age  
(B) Time of assimilation  
(C) Nature of reservoir or source rock  
(D) Synchronous mixing and fractionation
61. The assembly of all the continents in the Precambrian is known as  
(A) Pangaea (B) Laurentia  
(C) Amazonia (D) Rodinia
62. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :  
**Assertion (A)** : Boomerang shape pattern of the outcrop is resulted from superposed folding.  
**Reason (R)** : The upright fold must be superposed by another fold with inclined fold having horizontal axis perpendicular to that of the earlier fold.  
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)  
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)  
(C) (A) is true, but (R) is false  
(D) (A) is false, but (R) is true
63. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :  
**Assertion (A)** : According to Davis summital rounded concavity results from the action of soil creep in humid climate.  
**Reason (R)** : Creep results in by alternate dialation and contraction of the soil under the influence of gravity.  
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)  
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)  
(C) (A) is true, but (R) is false  
(D) (A) is false, but (R) is true



64. Which one of the following faults is not the part of the Himalayan mountain chain ?
- (A) Main Central Thrust  
(B) Main Boundary Fault  
(C) Great Boundary Fault  
(D) Himalayan Frontal Fault
65. How many types of stable triple junction are possible for a geologically significant length of time ?
- (A) 3  
(B) 14  
(C) 16  
(D) 125
66. In the sequence of terms what would be next polymorph of silica: beta cristobalite – alpha cristobalite – beta tridymite – alpha tridymite –
- (A) Alpha quartz  
(B) Beta quartz  
(C) Silica glass  
(D) Coesite
67. The minimum length solution for a purely underdetermined geophysical inverse problem can be expressed as [assume  $G$  is the kernel matrix and  $d$  is data]
- (A)  $[GG^T]G^{-1}d$   
(B)  $[GG^T][G^T]^{-1}d$   
(C)  $G^T[GG^T]^{-1}d$   
(D)  $[GG^T]^{-1}G^T d$
68. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :
- Assertion (A)** : The gravity fields obey Laplace Equation.
- Reason (R)** : The gravity field can be determined over an arbitrary surface if the gravity field is known completely over another surface assuming no masses are located between these two surfaces.
- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)  
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)  
(C) (A) is true, but (R) is false  
(D) (A) is false, but (R) is true



69. In the two Lists given below, List – I provides the geophysical methods, while List – II mentions the physical properties studied from the geophysical methods. Match the two Lists and choose the correct answer from the codes given below :

	<b>List – I</b>		<b>List – II</b>	
	<b>(Geophysical Methods)</b>		<b>(Physical Properties)</b>	
	a. Induced Polarisation	b. Controlled Source Electromagnetics	i. Shear velocity	ii. Chargeability
	c. Seismology	d. Ground Penetrating Radar	iii. Thermal conductivity	iv. Electrical resistivity
			v. Dielectric permittivity	
	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
(A)	iii	iv	ii	i
(B)	ii	iv	i	v
(C)	v	iii	iv	ii
(D)	iv	i	v	iii

70. Which logs are used to determine the porosity ?
1. gamma-gamma log.
  2. sonic log.
  3. neutron log.
  4. SP log.
- (A) 1, 2 and 3      (B) 2, 3 and 4  
(C) 1, 2 and 4      (D) 1, 3 and 4
71. Oceanic subtropical gyres are driven by
- (A) Equatorial easterly and subtropical westerly winds
  - (B) Subtropical easterly and polar westerly winds
  - (C) Equatorial westerly and subtropical easterly winds
  - (D) Subtropical westerly and polar easterly winds
72. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :
- Assertion (A)** : Protomylonite contains more than 50% megascopically visible porphyroclasts.
- Reason (R)** : Ultramylonite contains less than 10% porphyroclasts, smaller than 0.2 mm and most are reduced to fine grained streak.
- (A) Both (A) and (R) are true and (R) is correct explanation of (A)
  - (B) Both (A) and (R) are correct but (R) does not explain (A)
  - (C) (A) is true but (R) is false
  - (D) Both (A) and (R) are false



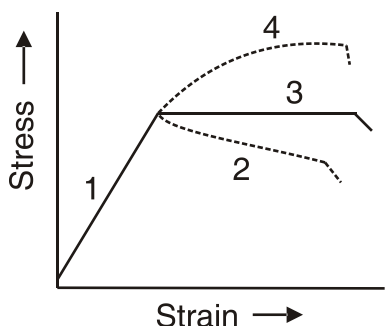
73. Which one of the following structures indicates synsedimentary deformation ?

- (A) Flaser Bedding
- (B) Convolute Bedding
- (C) Tabular Bedding
- (D) Graded Bedding

74. The laminar flow in a medium sand aquifer, the Reynolds number will be

- (A) <1
- (B) 10-100
- (C) 100-1000
- (D) >1000

75. Consider the following stress-strain diagram. Match the two lists and choose the correct answer from the codes given below the lists :



- |   |                            |
|---|----------------------------|
| <b>List – I</b>                             | <b>List – II</b>           |
| <b>Segment of the Stress-strain Diagram</b> | <b>Type of Deformation</b> |

- |      |                      |
|------|----------------------|
| a. 1 | i. Ideal plastic     |
| b. 2 | ii. Ideal elastic    |
| c. 3 | iii. Ideal viscous   |
| d. 4 | iv. Strain hardening |
|      | v. Strain softening  |
|      | vi. Semi-brittle     |

**Codes :**

- |     |          |          |          |          |
|-----|----------|----------|----------|----------|
|     | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
| (A) | iii      | i        | ii       | vi       |
| (B) | ii       | v        | i        | iv       |
| (C) | i        | vi       | iii      | iv       |
| (D) | iv       | iii      | ii       | v        |

76. The planet with a strong greenhouse effect, whose surface temperature averages 480°C is

- (A) Earth
- (B) Venus
- (C) Mars
- (D) Pluto

77. In the two Lists given below, List – I provides mineral whereas List – II gives the A, C and F values. Match the two Lists and choose the correct answer from the given options :

- |                  |                          |
|------------------|--------------------------|
| <b>List – I</b>  | <b>List – II</b>         |
| I. Anthophyllite | 1. A = 100, C = 0, F = 0 |
| II. Diopside     | 2. A = 50, C = 50, F = 0 |
| III. Anorthite   | 3. A = 0, C = 50, F = 50 |
| IV. Pyrophyllite | 4. A = 0, C = 0, F = 100 |

- |     |          |           |            |           |
|-----|----------|-----------|------------|-----------|
|     | <b>I</b> | <b>II</b> | <b>III</b> | <b>IV</b> |
| (A) | 4        | 3         | 2          | 1         |
| (B) | 1        | 2         | 3          | 4         |
| (C) | 3        | 2         | 1          | 4         |
| (D) | 2        | 3         | 1          | 4         |



78. An attribute data in the GIS is a
- (A) Point feature
  - (B) Geographical area feature
  - (C) Directional line feature
  - (D) Non-geographical descriptor relating to geographic feature

79. In vertical aerial photographs relief displacement increases when
- i. Distance from principal point increases
  - ii. Elevation of the point increases
  - iii. Flying height increases
  - iv. Focal length of camera increases

Choose the correct answer from the codes given below :

- (A) i and ii are correct
  - (B) iii and iv are correct
  - (C) ii, iii and iv are correct
  - (D) i, ii, iii and iv are correct
80. The meaning of 'Resurrected' landscape is closest to
- (A) Polyclimatic landscape
  - (B) Monocyclic landscape
  - (C) Multicyclic landscape
  - (D) Exhumed landscape

81. In the two lists given below, List – I provides the events of mass extinction in Earth's history and List – II gives their possible causes. Match the two lists and choose the correct answer from the codes given below :

**List – I**

**List – II**

- |                                     |   |
|-------------------------------------|---|
| a. End of Ordovician (440 m.y.ago)  | i. Meteorite impact and emission of radioactive rays                        |
| b. Late Devonian (365 m.y.ago)      | ii. Sharp drop in sea level, oceanic anoxia, eutrophication                 |
| c. Permian-Triassic (245 m.y.ago)   | iii. Global Cooling followed by phase of sudden global warming              |
| d. Cretaceous-Tertiary (65 m.y.ago) | iv. Formation of Pangea, population explosion of methane producing microbes |

- |     | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|-----|----------|----------|----------|----------|
| (A) | ii       | iii      | iv       | i        |
| (B) | iii      | ii       | iv       | i        |
| (C) | iii      | iv       | ii       | i        |
| (D) | iv       | ii       | iii      | i        |



82. Arrange the following in chronological order of their time of formation on Earth.

- i. Origin of organic compounds –  $\text{CH}_4$ , HCN
- ii. Eukaryotes
- iii. Origin of inorganic compounds – H,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$
- iv. Prokaryotes
- v. Origin of coacervates

- (A) i – iii – iv – ii – v  
(B) i – iii – iv – v – ii  
(C) iii – i – v – iv – ii  
(D) iii – i – v – ii – iv

83. The following two columns list marine microfossils and their paleoceanographic setting.

**List – I**

- |  |                             |
|--|-----------------------------|
| a. <i>Globigerina bulloides</i>          | i. Sub tropical water mass  |
| b. <i>Globigerinoides rubber (white)</i> | ii. Transitional water mass |
| c. <i>Neogloboquadri -napachyderma</i>   | iii. Tropical water mass    |
| d. <i>Globigerinoides rubber (pink)</i>  | iv. Polar water mass        |

**List – II**

Which one of the following is the correct match ?

- |     | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|-----|----------|----------|----------|----------|
| (A) | iv       | iii      | ii       | i        |
| (B) | i        | ii       | iii      | iv       |
| (C) | ii       | i        | iv       | iii      |
| (D) | iv       | ii       | iii      | i        |

84. Which one of the following is not a progressive trend seen in human evolution ?

- (A) Shortening of arms  
(B) Reduction in size and number of teeth  
(C) Increase in jaw power  
(D) Diminution in strength of brow-ridges

85. Which one of the following ages is represented by the index fossil *Cardita (Venericardia) beaumonti* the Indian subcontinent ?

- (A) Danian  
(B) Maastrichtian  
(C) Lutetian  
(D) Cenomanian

86. Pyrochlore in Carbonatites is rich in

- (A) Rubidium  
(B) Barium  
(C) Niobium  
(D) Strontium





87. Which of the following statements are true ?

- i. Sanidine and adularia are high end low temperature polymorphs of K-feldspar.
- ii. Kyanite, sillimanite and andalusite are polymorphs of Al-silicates.
- iii. Enstatite- bronzite-eulite-hypersthene-ferrohypersthene-ferrosilite represents isomorphous series.
- iv. Lepidolite and spodumene are Li-bearing mica and pyroxene respectively.

- (A) i, ii and iii are correct  
(B) ii, iii and iv are correct  
(C) i, ii, iii and iv are correct  
(D) i, ii and iv are correct

88. Porosity of a rock is expressed by

where  $\alpha$  is the porosity

$\rho_m$  is the grain density

$\rho_d$  is the bulk density

- (A)  $\alpha = 1 - \rho_d/\rho_m$   
(B)  $\alpha = 1 + \rho_d/\rho_m$   
(C)  $\alpha = 1 - \rho_m/\rho_d$   
(D)  $\alpha = 1 + \rho_m/\rho_d$

89. If the porosity of an aquifer is 30% and the specific retention is 10%, its specific yield would be

- (A) 0.1  
(B) 0.2  
(C) 0.3  
(D) 0.4

90. The relationship between Bulk modulus(K), Young's modulus(E) and Poisson's ratio ( $\nu$ ) is

- (A)  $\nu = \left( \frac{1}{4} - \frac{6K}{E} \right)$   
(B)  $\nu = \left( \frac{1}{2} - \frac{E}{6K} \right)$   
(C)  $\nu = \left( \frac{2 - 6K}{E} \right)$   
(D)  $\nu = \left( \frac{6K}{E} - 4 \right)$

91. The close similarity between the Nd and Sr initial isotopic compositions of most REE-Nb-F mineralized carbonatites and some oceanic islands suggests that the parental magmas are generated within

- (A) Inner core  
(B) Mantle  
(C) Lower crust  
(D) Upper crust



92. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :

**Assertion (A)** : Throughout the world Gold is present as one of the important placer deposits.

**Reason (R)** : Gold has high specific gravity, higher malleability toughness and chemical weathering resistant.

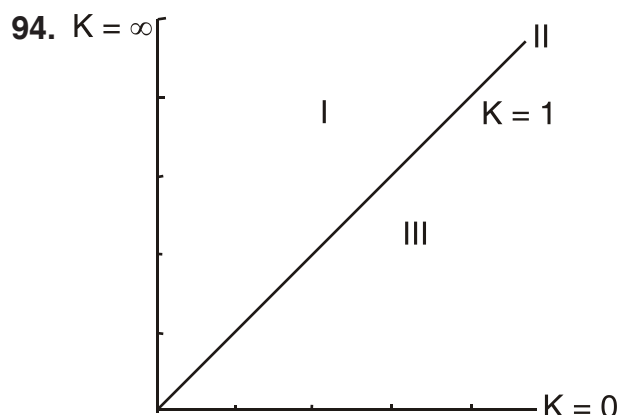
- (A) Both (A) and (R) are true and (R) explains (A)
- (B) Both (A) and (R) are correct, but (R) does not explain (A)
- (C) (A) is true, but (R) is false
- (D) Both (A) and (R) are false

93. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R). Read the statements and choose the correct answer using the codes given below :

**Assertion (A)**: The Pacific ocean is the major area of ferromanganesepolymetallic nodules.

**Reason (R)** : The sedimentation rate in the Pacific ocean is slowest among all the ocean.

- (A) Both (A) and (R) are true and (R) is correct explanation of (A)
- (B) Both (A) and (R) are correct, but (R) does not explain (A)
- (C) (A) is true, but (R) is false
- (D) Both (A) and (R) are false



In the Flinn diagram, fields I, II and III represent :

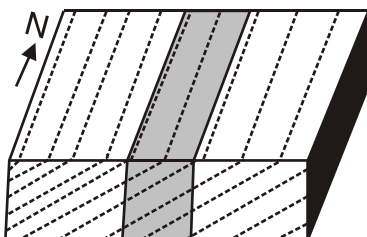
- (A) I – Prolate ellipsoid, II – Oblate ellipsoid and III – Plain strain
- (B) I – Prolate ellipsoid, II – Plain strain and III – Oblate ellipsoid
- (C) I – Plain strain, II – Prolate ellipsoid and III – Oblate ellipsoid
- (D) I – Oblate ellipsoid, II – Plain strain and III – Prolate ellipsoid

95. The last glaciations takes place in

- (A) Cretaceous
- (B) Carboniferous
- (C) Pleistocene
- (D) Pre-Cambrian



96. For the given figure the cleavage (shown by dotted lines) bedding plane relations select the correct code given below the Assertion (A) and Reason (R).



**Assertion (A)** : The relationship suggests syncline to right of the observer and does not plunge.

**Reason (R)** : In a non plunging fold the strike of the bedding plane is perpendicular to that of the cleavage.

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
- (C) (A) is true, but (R) is false
- (D) (A) is false, but (R) is true
97. Geo-chronostratigraphic unit that corresponds to Epoch is
- (A) Series                      (B) System
- (C) Stage                        (D) Zone

98. Which of the following factor(s) is/are responsible for the suppression of organic activity ?

- (A) Lack of oxygen and lack of  $H_2S$
- (B) Abundance of oxygen and lack of  $H_2S$
- (C) Lack of oxygen and abundance of  $H_2S$
- (D) Abundance of oxygen and abundance of  $H_2S$

99. Polymorphs of  $Al_2SiO_5$  (alumina-silicate) coexist at

- (A)  $501^\circ C$  and 0.376 GPa
- (B)  $511^\circ C$  and 0.376 GPa
- (C)  $550^\circ C$  and 0.376 GPa
- (D)  $551^\circ C$  and 0.376 GPa

100. The AKF ternary diagram is most suited for portraying the mineral assemblages of

- (A) Metamorphosed limestone and dolomite
- (B) Metabasalt
- (C) Metamorphosed
- (D) Metamorphosed aluminous sediments



Total Number of Pages : 20

Space for Rough Work

