

# EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCE

## Paper III

**Time Allowed : 2½ Hours]**

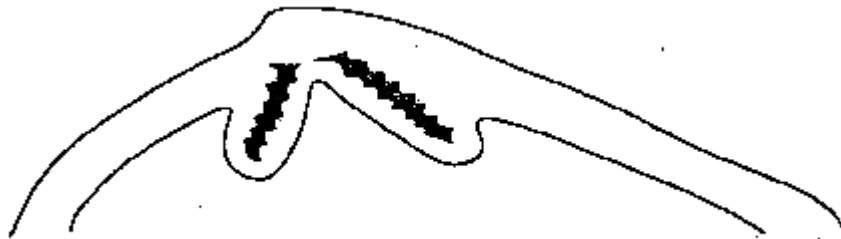
**[Maximum Marks : 150**

**Note :** This paper contains **Seventy Five (75)** multiple choice questions, each question carrying **Two (2)** marks. Attempt *All* questions.

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1. The accompanying sketch shows the interior umbral region of a bivalve. Dentition is the most important feature of the hinge. The dentition shown in the sketch is :

- (1) Schizodont
- (2) Heterodont
- (3) Taxodont
- (4) Adont



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

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[P.T.O.]

2. Match the following shell characters :

- |                |                                 |
|----------------|---------------------------------|
| (a) Isomyaria  | (i) <i>Trigonia</i>             |
| (b) Lunule     | (ii) Equal adductor impressions |
| (c) Schizodont | (iii) Anterior of umbone        |
| (d) Escutcheon | (iv) Posterior of umbone        |

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

3. Occurrence of which ammonoid did evince a Neocomian age for the East Coast Gondwanas ?

- (1) *Puzosia*
- (2) *Pascoeites*
- (3) *Reineckia*
- (4) *Schloenbachia*

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

4. External morphology of spores and pollens is described by a number of terms. Which set among the following does *not* belong here ?

- (1) Porate, colpate, colporate
- (2) Sulcate, laesurae, tetrad
- (3) Monolete, triporate, bisulcate
- (4) Colpate, dentate, laesura

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

5. Which term is applied to show extensive growth of the trunk of an elephant ?
- (1) Stem cells
  - (2) Supra myellium
  - (3) Extra epithelium
  - (4) Hypertrophy
- (A) 1 (B) 2  
(C) 3 (D) 4
6. The lapse rate of temperature is positive in :
- (1) Troposphere
  - (2) Mesosphere
  - (3) Stratosphere
  - (4) Thermosphere
- (A) (1) and (2) (B) (1) and (3)  
(C) (1) (D) (3) and (4)
7. During the second fortnight of May, a pilot flying from Mumbai to Srinagar may encounter which of the following aviation hazards ?
- (1) Dust storm
  - (2) Intense Thunderstorm
  - (3) High Turbulence
  - (4) Volcanic Ash
- (A) (1), (2) and (4) (B) (2) and (4)  
(C) (1), (2) and (3) (D) (2) and (3)
8. Which of the following regions of India are the principal beneficiaries of North-east Monsoon ?
- (1) Madhya Pradesh and Gujarat
  - (2) Assam, Meghalaya and Sikkim
  - (3) Arunachal Pradesh and Manipur
  - (4) Tamil Nadu and Kerala
- (A) (2) and (3) (B) (1) and (2)  
(C) (3) (D) (4)

9. Homogeneous nucleation in the atmosphere would occur when :
- (1) Relative Humidity is 400%
  - (2) Relative Humidity is 70%
  - (3) Relative Humidity is 500%
  - (4) Relative Humidity is 100%
- (A) (1) and (3) are correct                      (B) (4) is correct  
(C) (3) and (4) are correct                      (D) (2) and (4) are correct
10. The magnitude of coriolis force at latitude  $45^\circ$  is :
- (1) Same as that at equator
  - (2) Higher than that at equator
  - (3) Higher than that at latitude  $10^\circ$
  - (4) Higher than that at poles
- (A) (1)    (B) (2) and (3)  
(C) (3) and (4)    (D) (2), (3) and (4)
11. Unpaired alluvial terraces are likely to form in one of the following situations :
- (A) If a river is rapidly downcutting as its channel meanders laterally from one side of the valley to the other
  - (B) If a river is slowly downcutting as its channel meanders laterally from one side of the valley to the other
  - (C) If a river has cut downward in an intermittent fashion
  - (D) If a river has cut laterally in bedrock
12. Read the following statements and choose the *correct* answer :
- Statement I :** In general, channel deposits that accumulate by lateral accretion are finer than overbank flood deposits
- Statement II :** Point bars are the most important component of lateral accretion
- (A) Statements I and II are correct
  - (B) Statements I and II are incorrect
  - (C) Statement I is incorrect and statement II is correct
  - (D) Statement I is correct and statement II is incorrect

13. One of the following set of conditions favours extremely high drainage density :
- (A) Permeable rocks, steep slopes and low rainfall  
 (B) Impermeable rocks, steep slopes and high rainfall  
 (C) Impermeable rocks, gentle slopes and high rainfall  
 (D) Permeable rocks, gentle slopes and low rainfall
14. Identify whether the following statements are true *or* false :
- (a) Existing beaches are geologically of recent origin, having formed during late quaternary  
 (b) Beach face slope increases with grain size ( $> 4$  mm)  
 (c) The upper beach is generally more coarser and steeper than lower beach  
 (d) Beach cusps are most clearly developed where the beach sediment has a bimodal grain size distribution
- |           |       |       |       |
|-----------|-------|-------|-------|
| (a)       | (b)   | (c)   | (d)   |
| (A) False | False | True  | True  |
| (B) True  | True  | False | False |
| (C) True  | True  | True  | False |
| (D) True  | True  | True  | True  |
15. Read the following statements and choose the *correct* answer :
- (a) Lower troposphere is most affected by the daily changes in surface condition  
 (b) The height of the tropopause is higher at the equator  
 (c) In the standard atmosphere, the decrease of temperature with height in the troposphere is given as an average of  $6.5^{\circ}\text{C}/1000$  ft.  
 (d) Temperature inversion occurs above tropopause
- |           |       |       |       |
|-----------|-------|-------|-------|
| (a)       | (b)   | (c)   | (d)   |
| (A) False | True  | False | True  |
| (B) True  | True  | False | True  |
| (C) True  | False | True  | False |
| (D) False | False | True  | True  |

16. Vertisols occur in many parts of India. The vertisols do not display one of the following properties :
- (1) Vertisols develop on basic rocks and limestones
  - (2) Vertisols have high percentage of kaolinite because they occur only in humid climate
  - (3) Vertisols expand and contract more than any other soil type
  - (4) When wet, the vertisols have low permeability to water and the aeration is poor
- |           |       |       |       |
|-----------|-------|-------|-------|
| (1)       | (2)   | (3)   | (4)   |
| (A) True  | False | True  | True  |
| (B) False | True  | True  | False |
| (C) True  | True  | True  | True  |
| (D) True  | True  | False | False |
17. ....is the microwave sensor that determines the significant wave heights over the ocean surface.
- (A) Synthetic aperture radar
  - (B) Thematic mapper
  - (C) Shuttle imaging radar
  - (D) Radar altimeter
18. Select the *correct* statement :
- (A) Healthy vegetation appears red on false colour IR images
  - (B) Precise measurement of earth features can be obtained from all types of aerial photography
  - (C) Deforestation in Western Ghats can be best detected using radar images
  - (D) On aerial photographs objects standing above the terrain lean towards the principal point of a photo radially

19. The Hooke's law no longer holds beyond a certain value of stress is called the :
- (A) Elastic limit (B) Proportionality limit  
(C) Anelasticity (D) Failure
20. If a geological structure or deposit shows the following characters :
- (1) A relative low density  
(2) Negative magnetic susceptibility  
(3) Relatively high propagation velocity of seismic waves  
(4) High electrical resistivity
- Then it could be :
- (A) Salt dome (B) Metal deposit  
(C) Anticline (D) Fault plane
21. The surface in which all the particles vibrate with the same phase is called :
- (A) Wavelength (B) Surface wave  
(C) Wave front (D) Wave propagation
22. The geophysical tool which can determine the paleogeographic positions of geological part is :
- (A) Apparent polar wander paths (B) Magnetostratigraphy  
(C) Geodesy (D) Seismic Anisotropy
23. The transition from brittle to ductile types of deformation is thought to occur differently in oceanic and continental lithosphere due to several factors amongst :
- (1) Composition of rocks  
(2) Geothermal gradient  
(3) Isostasy  
(4) Gravity
- (A) (1) and (3) (B) (1) and (2)  
(C) (3) and (4) (D) (2) and (3)

24. Construction of a tunnel destroys the existing state of equilibrium in the material around it, the process of picking up the weight of the overburden by shearing forces requires the following :
- (1) Shearing strength of the overburden should not be less than the corresponding shearing stresses
  - (2) Shearing strength of the overburden be less than the corresponding shearing stresses
  - (3) The system of shearing stresses around an opening should be self-balanced
  - (4) Tensile strength of the overburden should be similar to the corresponding shearing stresses :
- (A) (1) and (3)   (B) (1) and (2)  
(C) (3) and (4)   (D) (1) and (4)
25. The ratio of interconnected pore space to bulk volume of rock is called :
- (A) absolute porosity   (B) effective porosity  
(C) total porosity   (D) Permeability
26. Clathrates containing hydrocarbon gas molecules are :
- (A) coal bed methane   (B) gas hydrates  
(C) shale gas   (D) tar sand
27. ....is the basic unit of lithostratigraphic classification.
- (A) Member   (B) Bed  
(C) Formation   (D) Group
28. Magnetostratigraphy is qualified as a chronostratigraphic tool based on the following merits :
- (1) Aperiodic nature of reversals
  - (2) Cyclic nature of reversals
  - (3) Global occurrence of reversals
  - (4) Sensitivity to depositional unconformities
- (A) (1), (2) and (4)   (B) (1) and (3)  
(C) (3) and (4)   (D) (1), (2) and (3)

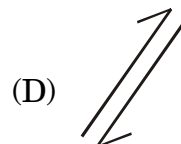
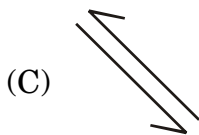
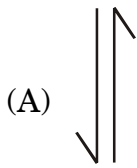
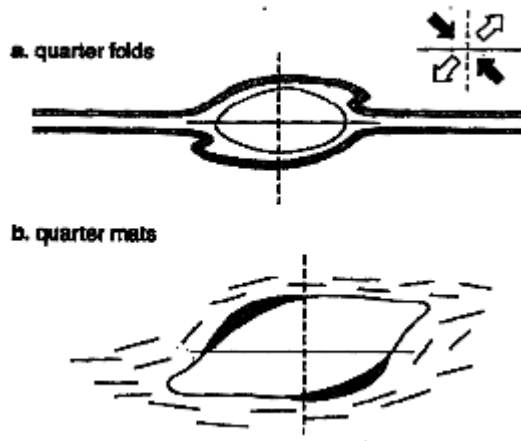


29. The level in the ocean where the rate of dissolution of carbonate balances the rate of accumulation is called..... .
- (A) Calcite Compensation Depth      (B) Carbonate Critical Depth  
(C) Carbonate Dilution      (D) Carbonate Dissolution
30. Phosphates in nodular form as well as large aggregate slabs and pebbles, occur abundantly on :
- (A) Continental slope and rise  
(B) Continental shelf and upper continental slope  
(C) Abyssal floor  
(D) Mid-oceanic ridges
31. Which of the following thrusts/faults in the Himalaya does not follow the decollement plane ?
- (A) Himalayan Frontal Fault  
(B) Main Boundary Thrust  
(C) Southern Tibetan Detachment Fault  
(D) Main Frontal Thrust
32. Melanges produced by gravitational sliding in the accretionary prism are called :
- (A) Xenolith      (B) Exotics  
(C) Molasse      (D) Olistostromes
33. Very fine grained matrix of carbonate rocks is termed as :
- (A) Micrite      (B) Sparry calcite  
(C) Microsparite      (D) Glass
34. A single channel river with high sinuosity ( $> 1.5$ ) is termed as :
- (A) straight river      (B) braided river  
(C) meandering river      (D) anastomosing river
35. The characteristics of lake deposits are strongly controlled by :
- (A) geometry      (B) climate  
(C) tectonics      (D) source rocks

36. In a concept of flow regime, which of the following characters of alluvial channel are typical of lower flow regime :
- (1) Resistance to flow is large and sediment transport is relatively small
  - (2) Fraude number is less than 1
  - (3) Resistance of flow is small and sediment transport is large
  - (4) Fraude number is greater than 1
- (A) (2), (3)                                      (B) (3), (4)  
(C) (1), (2)                                      (D) (1), (4)
37. The style of a folded surface can be described by the following elements :
- (1) Cylindricity
  - (2) Symmetry
  - (3) Aspect Ratio
  - (4) Duplexity
- (A) (1), (2) and (3)                                      (B) (1), (3) and (4)  
(C) (1) and (4)                                      (D) (3) and (4)
38. In microsection, nepheline is distinguished from orthoclase by :
- (A) pleochroism                                      (B) birefringence  
(C) extinction angle                                      (D) interference figure
39. A section of a mineral cut  $\perp$  to one of the optic axis of a biaxial mineral will give an interference figure with :
- (A) two curved isogyres
  - (B) one curved isogyre
  - (C) one rectilinear isogyre
  - (D) interference cross

40. The radiometric method used to date the oldest rock on Earth :
- (A) K-Ar (B) Ar-Ar  
(C) U-Pb (D) Re-Os
41. A field instrument that functions as a compass, clinometer and hand level is called as :
- (A) Total station (B) Brunton compass  
(C) Dumpy level (D) Theodolite
42. Optically uniaxial minerals belongs to :
- (1) Hexagonal system  
(2) Orthorhombic system  
(3) Monoclinic system  
(4) Tetragonal system
- (A) (1), (4) (B) (1), (2)  
(C) (1), (3) (D) (2), (3)
43. The BIF's are typically restricted to :
- (A) Archean metallogeny (B) Proterozoic metallogeny  
(C) Paleozoic metallogeny (D) Dharwar metallogeny
44. Manganese ore deposits of India are associated with :
- (1) Orthoquartzite-glaucanite-clay association  
(2) Limestone-dolomite-association  
(3) Volcanogenic association  
(4) Lateritoid association
- Which of these associations occur in the manganese ores of Central India ?
- (A) (1), (2) and (3) (B) (1) and (2)  
(C) (1) and (3) (D) (1), (2), (3) and (4)

45. Indicate the sense of shear in the diagram provided below :



46. Which of the following is/are *correct* statement/s for latitudes and longitudes ?

- (1) The linear distance between two successive latitudes remains same and that between two successive longitude changes
- (2) Both are essentially angular distances
- (3) The linear distance between two successive latitudes is not same whereas that between successive longitudes is always the same :

(A) (1) and (2)

(B) (2) and (3)

(C) (1) and (3)

(D) (2) and (4)

47. With a total length exceeding 60,000 km it is surprising to see that rocks from various places along mid-ocean ridges have essentially an identical helium isotopic composition, one way to explain this homogeneity is to assume :
- The upper mantle is very well mixed
  - The upper mantle is not differentiated
  - The lower mantle is poorly mixed
  - The lower mantle is very well mixed
48. The porphyry copper deposits of the world are considered to be special manifestations of :
- Subduction related magmatic activity
  - Flood basaltic magmatism
  - Ocean island basalt magmatism
  - Continental rift related magmatism
49. Two of the ocean ridges namely the Ninety-East ridge and Chagos-Maldweep-Lakshadweep island ridge are said to be volcanic tracts of two hot spots represented at :
- Kergulen island
  - Iceland
  - Reunion island
  - Tristan da Kunha
- (1), (3)
  - (1), (2)
  - (2), (4)
  - (2), (3)
50. Ultra-high pressure metamorphism is characteristic of :
- Collision zones
  - Continental rift zones
  - Mid-ocean ridge setting
  - Within plate setting

51. Arrange the following assemblages in ascending order of degree of metamorphism :
- (1) Albite—Zoisite—Calcite—Biotite—Hornblende
  - (2) Anorthite—Hornblende—Garnet
  - (3) Anorthite—Garnet—Diopside
  - (4) Andesine—Zoisite—Calcite—Biotite—Hornblende
- (A) (1), (4), (2), (3)    (B) (1), (2), (3), (4)  
(C) (4), (3), (2), (1)    (D) (3), (2), (4), (1)
52. Rare high pressure polymorphs of  $\text{SiO}_2$  known only from meteor impact craters include :
- (1) Tridymite
  - (2) Coesite
  - (3) Stishovite
  - (4) Cristobalite
- (A) (1) and (2)    (B) (2) and (3)  
(C) (3) and (4)    (D) (1) and (4)
53. If you are working in a part of the Deccan Volcanic Province and your area has rugged topography, a regionally developed precipitous western edge of the plateau and presence of highland laterite, then you are likely to be in :
- (A) Western Ghat Crest Zone
  - (B) On the main Deccan Plateau
  - (C) In Satpura region
  - (D) In Konkan region

54. Response of a soil subjected to dynamic loads or excitation by transient shear waves leading to complete loss of strength and its entry into liquefied state is known as :
- (A) Liquefaction (B) Liquidation  
(C) Fluidization (D) Hydration
55. Lanthanide series are characterised by :
- (A) progressive decrease in ionic size  
(B) increase in atomic weight  
(C) increase in ionic size  
(D) decrease in ionic charge
56. Incompatible elements are those :
- (A) elements which prefer to enter into melt during mantle melting  
(B) elements which stay back in solid residue of mantle  
(C) elements which remains in residue of crustal melting  
(D) elements which concentrate in lower mantle
57. Partition coefficients ( $C_S/C_L$ ) for the Heavy Rare Earth Elements (HREE) is higher for :
- (A) Olivine (B) Clinopyroxene  
(C) Orthopyroxene (D) Garnet
58. The texture of certain volcanics in which a bounding crystals protrude into abundant angular interstitial gas cavities is referred to as :
- (A) Pilotaxitic (B) Diktytaxitic  
(C) Epitactic (D) Trachytic

59. Bulk of fireclay/refractory clay deposits in India are in which of the following sequence/s ?

- (A) Gondwana Sequence (B) Precambrians of Kerala  
(C) Vindhyan Supergroup (D) Jurassic beds of Gujarat

60. A feldspar free lamprophyre is known as :

- (A) allivalite (B) troctolite  
(C) picrite (D) alnoite

61. If you are working in Maharashtra and the exposed Deccan Lava sequence shows the following characters, then you are in the area around which of the following cities ?

*Lava Sequence Characters :*

- (1) Large variation in composition of lava flows  
(2) Measurable westerly dips  
(3) Presence of intertrappean beds

*Cities :*

- (A) Mumbai (B) Pune  
(C) Nasik (D) Nagpur

62. Which major element variation diagram would enable to infer crystallisation of clinopyroxene ?

- (A) Mg Vs. Na (B) Cr Vs. Mg  
(C) Mg Vs. Al (D) Mg Vs. Ca

63. Identify *correct* pairs :

- (a) Trondhjemite (1) Basalt  
(b) Spheroidal weathering (2) Archaean crust  
(c) Diamond (3) Single cleavage  
(d) Achankovil shear (4) Central India  
(A) (a) 3, (b) 2 (B) (a) 2, (b) 1  
(C) (c) 1, (a) 3 (D) (d) 2, (a) 4



64. Which of the following scales is used for the measurement of intensity of earthquake ?

- (A) Richter scale
- (B) Modified Mercalli scale
- (C) Phi scale
- (D) Moh's scale

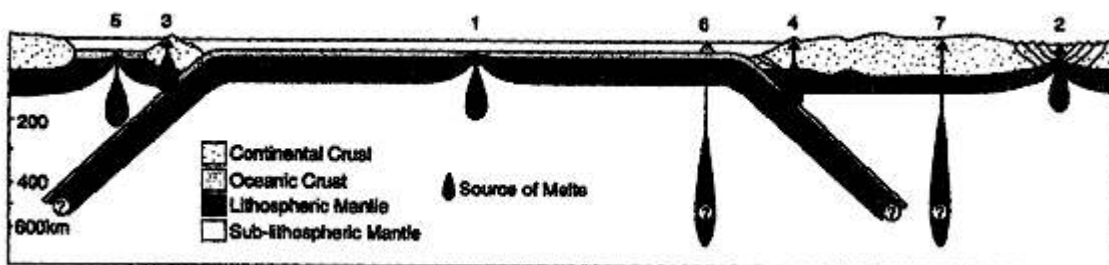
65. Which of the following terrains is characterised by :

- (1) absence of greenstone belts
- (2) absence of archaean grain
- (3) presence of paired metamorphic zones
- (4) presence of deep sea pelagic sediments

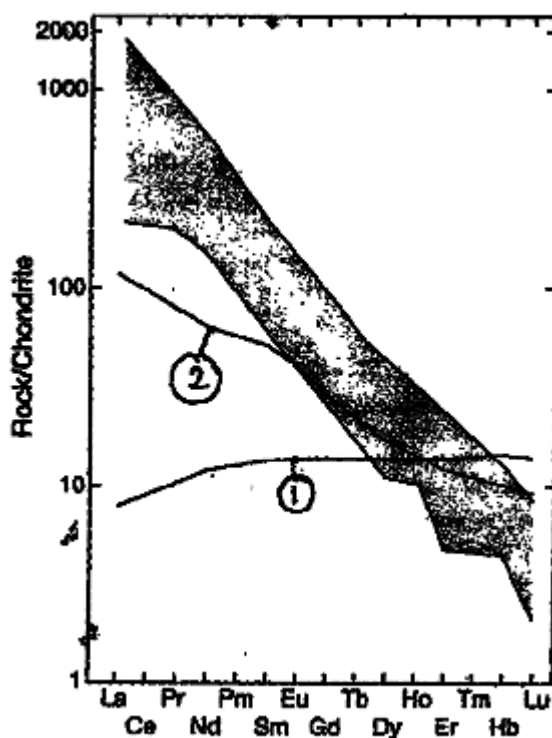
- (A) Dharwar Craton
- (B) Singbhum Craton
- (C) Aravalli Craton
- (D) Himalaya

66. Identify the type of tectonic setting at 1 and 3 in the following figure :

- (A) oceanic rift and continental rift
- (B) oceanic rift and ocean-ocean convergence
- (C) ocean-ocean convergence and continent ocean convergence
- (D) oceanic rift and ocean-ocean convergence



67. In the given REE diagram identify the possible magma types at 1 and 2 :



- (A) MORB and IAB
  - (B) MORB and CFB
  - (C) MORB and OIB
  - (D) OIB and IAB
68. The oldest continental fragments preserved because :
- (A) oldest continental fragments are lighter
  - (B) oldest continental fragments develop refractory roots
  - (C) oldest continental fragments contain high density limologies
  - (D) oldest continental fragments are floating

69. The oldest dated gneiss in the Dharwar craton is :  
 (A) Gorur gneiss (B) Kambha gneiss  
 (C) Bangalore gneiss (D) Tirodi gneiss
70. Partitioning of effective rainfall between surface water run off and groundwater discharge during a recharge season can most effectively be calculated by :  
 (A) Evapotranspiration method  
 (B) Stream discharge method  
 (C) Resistivity method  
 (D) Borehole hydrograph method
71. In the following map showing a part of Peninsular India, identify the provinces/ sedimentary basins numbered 1, 2, 3 and 4 :



- | 1                       | 2                   | 3            | 4                   |
|-------------------------|---------------------|--------------|---------------------|
| (A) Gondwana            | Vindhyan            | Chhattisgarh | Chota Nagpur Gneiss |
| (B) Chota Nagpur Gneiss | Gondwana            | Vindhyan     | Chhattisgarh        |
| (C) Chota Nagpur Gneiss | Chhattisgarh        | Vindhyan     | Gondwana            |
| (D) Vindhyan            | Chota Nagpur Gneiss | Gondwana     | Chhattisgarh        |

72. Genera which have a very long range and have representatives in the present day waters are aptly called as living fossils. Which is a very typical example of a living fossil ?

- (1) *Neithea*
- (2) *Miliolite*
- (3) *Megalodon*
- (4) *Lingula*

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

73. Match the following :

- |  |                                  |
|--|----------------------------------|
| (a) This force is zero at the equator  | (1) Local wind on mountain slope |
| (b) Chinook wind   | (2) Friction                     |
| (c) The difference in pressure over space  | (3) Rotational forces            |
| (d) This wind is a function of change in air temperature and pressure over land in contrast to that over water | (4) Coriolis                     |
|  | (5) Land and sea breezes         |
|  | (6) Pressure gradient            |
|  | (7) Gradient winds               |
|  | (8) Geostrophic winds            |

- |       |     |     |     |
|-------|-----|-----|-----|
| (a)   | (b) | (c) | (d) |
| (A) 3 | 2   | 1   | 4   |
| (B) 4 | 1   | 6   | 5   |
| (C) 2 | 7   | 5   | 1   |
| (D) 3 | 8   | 7   | 1   |

74. Tone of rock on SLAR image is dependent on :

- (A) rigidness of rock
- (B) colour of rock
- (C) porosity of rock
- (D) magnetic properties of rock

75. In the upper mantle, at depths of about 75 (a) 250 km (b) there is a region

in which the seismic velocity is :

- (i) Lower than the region above (a) and below (b)
- (ii) Higher than the region above (a) and below (b)
- (iii) Same as the region above (a) and below (b)
- (iv) Zero than the region above (a) and below (b)

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**ROUGH WORK**