

Indian Statistical Institute
Junior Research Fellowship in Geology, Entrance Examination
2015

BOOKLET No.

TEST CODE: **GEB**

Afternoon

Time: 2 hours

Part I - one question	1 X 25 = 25
Part II –five questions	5 X 8 = 40
Part III –five questions	5 X 4 = 20
Part IV –fifteen questions	15 X 1 = 15
Total	100

Give your answers in the answer booklet only.

Write your Name, Registration Number, Test Centre, Test Code and the Number of this booklet in the appropriate places on the answer sheet.

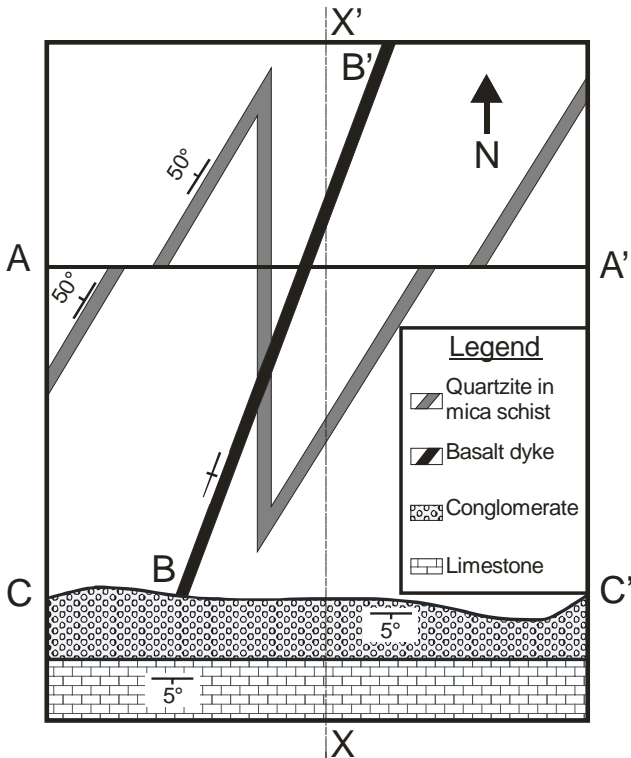
STAPLE/ATTACH QUESTION BOOKLET WITH THE ANSWER BOOKLET. ALL ROUGH WORK MUST BE DONE ON THE QUESTION BOOKLET AND/OR ON THE ANSWER BOOKLET.

WAIT FOR THE SIGNAL TO START WRITING

Part-I

(One question, twenty five marks)

1.



The given map pattern was observed on a flat topographic surface. AA' is a normal dip-slip fault and BB' is a vertical basalt dyke.

- 1) What is the approximate dip direction of the fold axial plane considering a cylindrical fold? [5]
- 2) Which block (i.e., northern or southern) is upthrown by the fault AA'? [5]
- 3) What is the nature of the contact CC'? [5]
- 4) Draw a sketch geological cross-section along the line XX' and arrange the lithounits that are younger than the folded units according to their relative age. [10]

Part-II

(Five questions, eight marks each)

2. (i) What is 'Carbonate Compensation Depth' (CCD)?

(ii) How does it control the accumulation of pelagic carbonates in modern ocean basins?

(iii) How does CCD generally vary with latitude in the present day ocean basin?

(iv) Are CCD values for aragonite and calcite same in a modern ocean basin?

(v) Name two groups of microorganisms that occur in abundance in modern pelagic carbonates.

(vi) Explain how accumulation of siliceous ooze and pelagic claystone generally take place below CCD in modern ocean basins.

3+1+1+ 1+ 1+1

3. What do you understand by the term "Unconformity"? Illustrate successive stages of development of an angular unconformity. Describe with sketches the other types of unconformities.

1+4+3

4. Explain why the following assemblages are NEVER found in rocks

i. Quartz and nepheline

ii. Diopside and corundum

4+4

5. What is macroevolution? Why we do not get

i. Fossils of hominids from the Gondwana sediments of India?

ii. Fossils of dinosaurs from the Siwalik deposits of India?

4+2+2

6. Draw sketches of different types of triple point junctions of plate boundaries that are kinematically possible.

8

Part-III

(Choose the correct answer from the given alternatives and justify. Five questions, four marks each)

7. Which of the following is NOT a fossil?

- a) Dinosaur track-way.
- b) *Hipparion* tooth.
- c) *Archaeopteryx*.
- d) Egyptian mummy.

8. Which of the following will not be reliable for paleoslope determination?

- a) Clast imbrications in braided river deposits of orthoconglomerates.
- b) Large scale cross strata in an aeolian erg deposits.
- c) Flute cast in the sandy turbidite beds.
- d) Slump folds in delta front sediments.

9. A sedimentary bed contains three different fossils: A, B and C. Fossil A represents organism that only existed in Cambrian and Ordovician Periods; organisms representing fossil B only existed in Ordovician; Fossil C has a long stratigraphic range through Cambrian to the Triassic Period. Based on this fossil assemblage the age of the host rock is:

- a) Cambrian.
- b) Ordovician.
- c) Sometime between Cambrian and Triassic.
- d) Impossible to determine.

10. Fractional crystallization of a mafic magma at depth leads to various rocks as the crystallization proceeds through different stages. Which of the following gives correct pairing of rock type and stage of crystallization?

- a) Olivine gabbro late stage.
- b) Norite early stage
- c) Pegmatite very early stage
- d) Anorthositic gabbro late stage.

11. A schist contains tremolite-actinolite as a metamorphic mineral. The best possible protolith set for the schist is given by

- a) Limestone, arkose, shale.
- b) Limestone, rhyolite, shale.
- c) Marl, greywacke, dacite.
- d) Marl, mafic tuff, basalt.

Part-IV

(Choose the correct answer from the given alternatives. No Justification is required. Fifteen questions, one mark each)

12. A deformed and metamorphosed granite contains zircon. Zircon U-Pb age obtained from the granite is recorded as 1884 Ma. Which of the following statements provide the best possible interpretation of the zircon age?

- (a) Age of crystallization of the granite.
- (b) Age of crystallization of the granite provided there was no Zr loss due to deformation.
- (c) Age of crystallization of the granite provided the clock was not reset due to granulite facies metamorphism and/or deformation.
- (d) Age of metamorphism of the granite.

13. The following mineral pairs can be distinguished under optical microscope by using one or more of the following criteria:

Nature of cleavage, R.I. (relief), maximum interference colour, twinning, extinction angle, absorption colour, optic axis figure.

Which of the following gives the WRONG combination of mineral pair and distinguishing characters?

- (a) Quartz & plagioclase; --- twinning, R.I., cleavage, optic axis figure.
- (b) Hypersthene & hornblende; --- cleavage, max. interference colour, pleochroism.
- (c) Kyanite & sillimanite;--- twinning, R.I., cleavage, absorption colour.

- (d) Chlorite & biotite; --- absorption colour, interference colour, extinction angle.

14. Following feature most probably represent a schistosity:

- a) Parallel orientation of flaky minerals in a rock
- b) Planes along which the rock breaks easily.
- c) Oblique relationship between bedding and a pervasive foliation.
- d) Close-spaced fractures present in a rock body.

15. Which of the following is the high temperature- high pressure polymorph of SiO_2 ?

- a) Opal.
- b) Tridymite.
- c) Stishovite.
- d) Cristobalite.

16. Most diagnostic feature of an aeolian deposit is

- a) Polymodal paleocurrent pattern.
- b) Well sorted nature of the sediments .
- a) Presence of large planar crossbeds .
- b) Pin-stripe laminations with distinct inverse grading.

17. What are the two most abundant elements in the Earth's crust?

- a) Iron and magnesium.
- b) Oxygen and Silicon.
- c) Nitrogen and Oxygen.
- d) Silicon and calcium.

18. All paleospecies are

- a) Morphospecies.
- b) Crown-group species.
- c) Stem-group species.
- d) Ichnospecies.

19. Calcite crystallizes in

- a) Cubic system.
- b) Triclinic system.
- c) Hexagonal system.
- d) Trigonal system.

20. Bilinear image re-sampling method is NOT suitable for:

- a) Landsat 7 imagery.
- b) Panchromatic imagery.
- c) Digital elevation model.
- d) Thematic raster.

21. Which of the followings is a Period?

- a) Neoproterozoic.
- b) Proterozoic.
- c) Devonian.
- d) Maastrichtian.

22. Which of the following organisms can be used as a geochronometer?

- a) Brachiopods.
- b) Corals.
- c) Gastropods.
- d) Bivalves.

23. Fossils generally provide the

- a) Relative ages of their host rocks.
- b) Absolute ages of their host rocks.
- c) Absolute ages of their host rocks with nearly 50 Ma error limit.
- d) Relative ages of their host rocks with nearly 50 Ma error limit.

24. Hummocky cross-stratification is generally interpreted to have formed

- a) Below mean storm wave base.
- b) Between mean fair weather wave base and mean storm wave base.
- c) Between mean high water and mean low water level.
- d) Between mean fair weather wave base and mean low water level .

25 . Axial Plane of an anticlinal fold has an orientation of $250^{\circ}/42^{\circ}$ --->N and its hinge line plunges 40° → 336° . The fold may be described as:

- a) Upright fold.
- b) Recumbent fold.
- c) Reclined fold.
- d) Asymmetrical fold

26. A sandstone contains ammonite shells. A detrital zircon grain obtained from the same sandstone has yielded radiometric age of 1500 Ma. The age of the sandstone could be:

- a) Mesoproterozoic.
- b) Paleoproterozoic.
- c) Jurassic.
- d) Quaternary.