

National Exams: December 2018

18-Geol-A3, Sedimentation and Stratigraphy

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK with NO CALCULATOR PERMITTED exam.
3. This exam paper consists of three pages (including this cover page). There are two parts: **Part 1** (Questions 1-12) conveys questions related to Sedimentology and Sedimentary Processes whereas **Part 2** (questions 13-19) conveys questions related to Stratigraphy and sedimentary basin analysis.
4. Part 1 consists of 12 questions. Answer **questions 1 and 2, and any other 6 questions from the remaining 10 questions (i.e., questions 3-12)**. Each question weighs 5 points. Therefore, this Part 1 has total marks 40 (8 questions X 5 = 40 points).
5. Part 2 consists of 7 questions. Answer **any five** questions of your choice. Each question weighs 5 points. Therefore, this Part 2 has total marks of 25 (5 questions X 5 = 25 points).
6. **The maximum attainable grade is 65/65 (40 for Part 1, and 25 for Part 2).**
7. Most questions require an answer in essay format. Clarity and organization of the answers are important.
8. **Please note:** The first number of questions permitted to answer in each part (i.e., Part 1 & Part 2) will be marked as they appear in the answer book. Thus, don't answer more than what you were instructed to answer.

Part 1: Sedimentology

Answer eight (including questions 1 and 2) of the following 12 questions. 5 points each (8 X 5 = 40 points total). Note: Questions 1 and 2 must be answered. Answer 6 from the remaining 10 questions (i.e., questions 3-12).

- 1- Provide the classification scheme of carbonate rocks based on (i) Dunham's classification (1962) with modifications by Embry & Klovan (1972) and (ii) Folk's classification. Table formats are acceptable.
- 2- Explain and sketch sandstone classification scheme.
- 3- Paleocurrent directions of sandstones can give information about the depositional processes. Provide three sedimentary structures that are useful for gathering paleocurrent data. By plotting paleocurrent data on rose diagram, explain three most common paleocurrent patterns and the depositional processes they represent.
- 4- Carbonate sediments are mainly produced in extensive shallow marine environments known as carbonate platforms. Explain the different types of carbonate platforms. For each type of a platform, explain its energy distribution and its effects on the sediments.
- 5- The textural maturity of sandstones is in function of the input of the kinetic energy that acts upon the sediments during transportation and deposition. Describe how the parameters of textural maturity of sands evolve with the increase of the modifying kinetic energy.
- 6- Describe the terms conglomerate and diamictite. Also provide their classification based on clast stability and fabric support.
- 7- Describe the term breccia. What are the different processes that generate breccia?
- 8- Discuss the importance of grain-size data in the application of (i) petroleum production, (ii) groundwater studies, and (iii) interpretation of depositional processes.
- 9- Siliceous sedimentary rocks can be either bedded or nodular cherts. Explain the genesis of the two types and the source of silica for each type.
- 10- Describe the term "Diagenesis" and its effect on reservoir qualities of rocks.
- 11- Define the principal components of a deltaic depositional system. Which depositional unit contains the best (conventional) reservoir potential?
- 12- Choose the most appropriate term: The sandstone framework grains that are most useful for deciphering the nature of the source (grain provenance) rocks are:
 - a) Quartz grains
 - b) feldspars
 - c) matrix grains
 - d) lithic grains
 - e) micas

Part 2: Stratigraphy and sedimentary basin analysis.

Answer five of the following seven questions (5 points each. Total points to answer: 5 X 5 = 25)

- 13- Describe the term "Facies" and the concept of Walther's Law of facies succession.
- 14- Formation is the fundamental unit of lithostratigraphic classification. The boundaries between different formations may occur vertically and laterally. Explain all types of vertical and lateral boundaries that separate formations (excluding tectonic contacts).
- 15- Explain the different types of parasequence sets (progradational, aggradational and retrogradational) and their genesis in terms of the interaction between deposition and accommodation space.
- 16- Not all fossils are good for biostratigraphic age dating. Explain why? Also state the specific criteria that fossils useful for biostratigraphic age dating must meet.
- 17- Define two of the following terms:
a) Diastem, b) Microfacies, c) Assemblage biozone, d) Polarity zone
- 18- Explain the term "Depositional Sequence" and the different system tracts that constitute a fully-developed sequence.
- 19- From the list below (a to j), relate the sedimentary basins to the tectonic regimes that generate them. Put the letters for the different sedimentary basins in the appropriate boxes under their tectonic regime.

- a) Rift basin b) Passive margin basin c) Foreland basin d) Aulacogen
- e) Retro-arch basin f) Intracratonic basin g) Fore-arch basin h) Pull-apart basin
- i) Wrench Basin j) Mariana Trench

Basins related to extensional tectonic setting	Basins related to transform tectonic setting	Basins related to convergent tectonic setting