

National Exams: December 2017

04-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, NO CALCULATOR PERMITTED EXAM.
3. This exam paper consists of four pages (including this cover page). There are two parts: **Part A** (Questions 1-11) conveys questions related to Sedimentology and Sedimentary Processes whereas **Part B** (questions 12-17) conveys questions related to Stratigraphy and sedimentary basin analysis.
4. Answer **seven (7)** questions from Part A and **four (4)** questions from Part B. Each question in both parts is 10 points. Therefore, the maximum attainable grade is 70 from part A and 40 from part B, giving a total of 110/110.
5. Most questions require an answer in essay format. Clarity and organization of the answers are important.
7. **Please note:** The first number of questions permitted to answer in each part (i.e., Part A & Part B) will be marked as they appear in the answer book. Thus, do not answer more than what you have been asked to answer.

Part 1: Questions on Sedimentary processes: Answer seven of questions 1 to 11.

Question 1 (10 points)

There are physical and chemical weathering processes that affect subaerially-exposed rocks. Give two examples of each of these weathering processes and explain how they affect the rocks.

Question 2 (10 points)

What is a paleosol and how can it be recognized?

Question 3 (10 points)

Describe the term “diagenesis”? State the different diagenetic stages that affect siliciclastic sedimentary rocks with at least one example of diagenetic process and related product in each stage.

Question 4 (10 points)

A sandstone rock is composed of framework grains, matrix and cement.

- a. State the particles that constitute the framework grains, the matrix and two most common minerals that form cements;
- b. Sketch classification of sandstones by using QFL ternary diagram. Define the different types of sandstone classes or types.

Question 5 (10 points)

Provide Dunham’s (1962) classification of limestone with modifications by Embry & Klovan (1972). Table format is acceptable.

Question 6 (10 points)

Most carbonate sediments accumulate in extensive shallow marine environments known as carbonate platforms. Explain the different types of carbonate platforms and how their morphological differences affect energy and facies distribution across each type of platform.

Question 7 (10 points)

Explain the textural and mineralogical differences among sediments deposited by glacial, eolian and beach processes. Also state what causes such kind of differences.

Question 8 (10 points)

Pelagic and hemipelagic deposits may include ----- (Circle **all** applicable terms):

- | | | |
|-------------------------------------|---|---------------------------|
| a) Calcareous planktonic organisms, | b) silicious-shelled planktonic organisms | |
| c) clay minerals | d) fine-grained quartz | e) fine-grained feldspars |
| f) soil | g) radiolarians & diatoms | h) biogenic oozes |
| i) coral reefs | j) ooids | |

Question 9 (10 points)

Explain and sketch how rip currents and longshore currents form? Discuss their effect on sediment dispersal.

Question 10 (10 points)

Sketch and explain a depositional model of a meandering river system. Show the different features associated with a meandering river depositional system.

Question 11 (10 points):

Two multiple choices questions: choose the most appropriate answer that completes each statement.

11A) If sediment particles on a streambed are mud to fine-sand size and lie within the viscous sublayer, the near-bed flow _____.

- a) -is dominated by viscous forces and the flow becomes hydraulically smooth.
- b) -is dominated by viscous forces and the flow becomes hydraulically rough.
- c) -is dominated by turbulent forces and the flow becomes hydraulically rough.
- d) -is dominated by turbulent forces and the flow becomes hydraulically smooth.

11B) Cruziana ichnofacies indicates _____ depositional setting.

- | | |
|-------------------------------|---------------------------------------|
| a) Sandy shore | b) rocky coast |
| c) deep marine (abyssal) zone | d) relatively quiet, sublittoral zone |

Part 2: Stratigraphy and sedimentary basin analysis.

Answer four of the following 6 questions (questions 12 to 17). Total points: 4 questions X 10 = 40)

Question 12: 10 points

What are the fundamental (or primary) units for lithostratigraphy, biostratigraphy, magnetostratigraphy and chronostratigraphy. Also state and briefly describe the various ranks of lithostratigraphic units.

Question 13: 10 points

Describe the Principle of faunal succession and explain how it is applicable to sedimentary basin analysis.

Question 14: 10 points

Explain structure-contour map, isopach map & lithofacies map, as well as their importance in basin analysis

Question 15: 10 points

Explain the term depositional sequence. What are the systems tracts that constitute a depositional sequence? Explain how these systems tracts are related to sea level changes.

Question 16: 10 points

What is the difference between conformable and unconformable stratigraphic boundaries? Describe the different types of unconformable contacts.

Question 17: 10 points: Two multiple choice questions: choose the most appropriate answer for each one.

17A- Which of the following basins is related to convergent tectonics?

- a- Passive margin basin b- Foreland basin c- Aulacogen d- Intracratonic basin

17B- Which one of the following properties does not conform with syn-depositional tectonic activities?

- a) Differential subsidence within the basin.
b) Significant lateral variations in thickness of the sedimentary fill.
c) Faults dying out upward and terminate within the sedimentary fill.
d) Pronounced lateral facies changes.