UNAM

FACULTY	Faculty of Agriculture, Engineering & Natural Sciences		
DEPARTMENT	Geosciences		
SUBJECT	Petroleum Systems and Geochemistry		
SUBJECT CODE	S6911GP		
PAPER	1: combined theory & practical		
DATE	June 2026		
DURATION	**180 min (3 hours)**	**MARKS**	100

FIRST OPPORTUNITY EXAMINATION

Examiner/s: Dr C-I Uahengo

Internal Moderator: Dr M Harris

External Moderator: Prof Mimonitu Opuwari

This question paper consists of 4 pages (including this one)

Instructions

- Closed book examination
- Answer all questions.
- Answer each question on a new page
- Recommendation: read first all subordinate questions before you answer.

UNIVERSITY OF NAMIBIA EXAMINATIONS

Question 1

An offshore passive margin basin contains organic-rich Type II shales deposited during a transgressive systems tract. These are overlain by deep-marine turbiditic sandstones and capped by regionally extensive marine shales.

a) Analyse how sequence stratigraphic architecture controls the spatial distribution of the source rock, reservoir rock, and seal in this petroleum system. (4)
b) Analyse the significance of timing between hydrocarbon generation, migration, and trap formation in determining whether the system becomes productive. (4)
c) Evaluate the main causes of charge failure that may affect this system. (2)

Question 2

Rock-Eval pyrolysis results from a potential source rock interval are as follows: TOC = 4.5 wt.%; Tmax = 445°C; HI = 550 mg HC/g TOC

a) Evaluate the organic richness and kerogen type of the source rock using these parameters. (4)
b) Evaluate the thermal maturity of the source rock. (3)
c) Assess the likely hydrocarbon generation potential of this interval. (3)

Question 3

A Van Krevelen diagram for a set of source rock samples shows progressive decreases in both H/C and O/C atomic ratios with increasing burial depth.

a) Analyse what these changes indicate about kerogen transformation during burial and heating. (4)
b) Interpret the dominant hydrocarbon products expected at different stages of this transformation. (4)
c) Evaluate what the observed trend indicates about the maturity progression of the source rocks. (2)

Question 4

Geochemical analysis of an oil sample shows dominance of steranes and low pristane/phytane (Pr/Ph) ratios (<1). The oil is suspected to be derived from a marine source rock.

a) Evaluate the depositional environment of the source rock based on the biomarker evidence. (4)
b) Assess the redox conditions prevailing during deposition. (3)
c) Evaluate the implications of these biomarker signatures for source–oil correlation. (3)

Question 5

Seismic and core data from a deep-marine basin reveal channelized sandstone bodies interpreted as turbidite deposits.

a) Analyse the depositional architecture of these channelized systems. (4)

b) Analyse how sedimentary heterogeneity within these deposits affects fluid flow and reservoir connectivity. (4)
c) Evaluate the overall reservoir quality of such systems. (2)

Question 6

A faulted reservoir-seal system is identified in an offshore basin. Seismic data shows faults cutting through both the reservoir and the overlying seal.

a) Evaluate the factors that control whether a fault acts as a seal or a conduit for hydrocarbon leakage. (4)
b) Assess the impact of fault behaviour on hydrocarbon preservation and trap integrity. (4)
c) Propose appropriate methods used to evaluate fault seal integrity in such a system. (2)

Question 7

In a frontier basin, hydrocarbon accumulations are present but migration pathways are poorly constrained.

a) Analyse the mechanisms of primary and secondary hydrocarbon migration in sedimentary basins. (4)
b) Analyse the role of carrier beds and structural features in controlling migration pathways. (4)
c) Evaluate the factors that influence migration efficiency and charge success. (2)

Question 8

An energy company is comparing investment opportunities between the upstream petroleum sectors of Namibia and Nigeria.

a) Evaluate the geological maturity of petroleum systems in Namibia and Nigeria, with reference to basin evolution and discovery history. (4)
b) Evaluate the exploration risks associated with each country, considering geological, technical, and operational factors. (3)
c) Assess the future exploration potential of both regions, providing justification. (3)

Question 9

You are tasked with evaluating a frontier offshore basin with limited well data but available seismic and regional geological information.

a) Define the key elements of a petroleum system that must be identified in this basin. (4)
b) Integrate the major processes (generation, migration, accumulation, and trapping) into a coherent petroleum system model. (4)
c) Justify an exploration strategy for this basin based on your model. (2)

Question 10

An international oil company is planning to develop a newly discovered offshore hydrocarbon field in a frontier basin.

a) Evaluate the key stages of the exploration and production (E&P) life cycle, from basin screening to field abandonment. (4)
b) Assess the major geological, technical, and economic uncertainties associated with each stage. (4)
c) Propose appropriate mitigation strategies to reduce risk across the life cycle. (2)

END OF EXAMINATION