



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION : BACHELOR OF SCIENCE HONOURS	
QUALIFICATION CODE: 08BOSH	LEVEL: 8
COURSE CODE: AGE811S	COURSE NAME: ADVANCED GEOPHYSICS
SESSION: JUNE 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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ANSWER QUESTION ONE (1) AND ANY OTHER THREE (3)

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)

QUESTION 1: Compulsory**[25]**

1. Indicate the primary geophysical (potential field) method/s that can be used in the following applications: give a brief explanation why that is the most suitable (the use of diagrams appropriately will attract marks):
 - (a) Exploring a gneiss for massive sulphide mineralisation (5)
 - (b) reconnaissance exploration of iron deposits on a large scale of 100 km x 100 km (Magnetite and hematite combined). (5)
 - (c) Investigating for a subsurface salt dome. (5)
 - (d) Identification of pollution/pollutants of fresh ground water on a municipal landfill or waste disposal site. (5)
 - (e) Screening a mining area for acid mine drainage solutions from the oxidation of pyrite from their tailings dam. (5)

QUESTION 2**[25]**

- 2.(a) Write the general formula which expresses the form and amplitude of a gravity (or magnetic) anomaly. Briefly explain the effect on an anomaly of each of the parameters in the formula and outline possible ambiguities. (10)
- (b) Show, with the aid of a sketch, the effect on a magnetic anomaly of taking readings at too coarse a spacing. Discuss how this will affect interpretation? (5)
- (c) What are the two effects on a magnetic (or gravity) anomaly of burying its source at progressively deeper depths? (4)
- (d) Show three differences between a gravity and magnetic anomaly. (6)

QUESTION 3**[25]**

- (a) Discuss the corrections applied to gravity data in order to produce a Bouguer anomaly map. (4)
- (b) The magnetic data is normally produced in Total Magnetic intensity anomalies. From this is calculated the First Vertical Derivative and Analytical Signal. List the benefits, and drawbacks, of doing so in each case. (9)
- (c) What is the function of a base station in magnetics and gravity surveys? How would Sunspot activity affect your surveys and what time of the day would be best suited to carry a magnetic survey. (2, 2, 2)
- (d) Sketch a gravity anomaly across the chromite ore body in Figure 1 below. Give a brief explanation outlining why the anomaly shapes differ. (6)

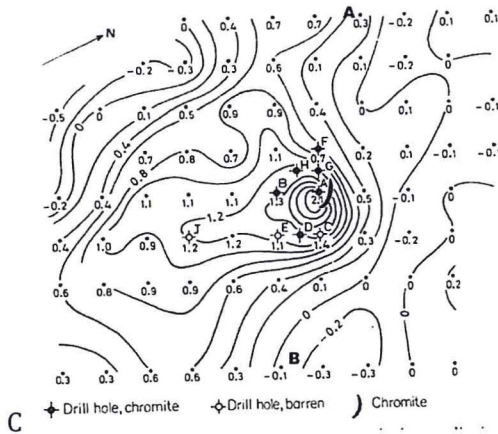


Figure 1 .

QUESTION 4**[25]**

- (a) Figure 2 shows a simple pendulum, suspended by a *mass less* rod, l and a weight M . Given the parameters in the diagram, l , M , g and the angle ψ , derive a formula for the swing of a pendulum. Find the kinetic energy and velocity of the pendulum with $L = 30$ cm, and $m = 500$ g. Use $g = 9.81$ m/s². (15)
- (b) Discuss what would happen to the value of g , if different values of M were used, and explain why. What does this simple experiment tell us about gravimeter calibrations. (5)

- (c) Derive the expression for Newton's universal gravitational law, and equate it to the formula: $F = ma$. Discuss the resultant expression and its fundamental usefulness. (5)

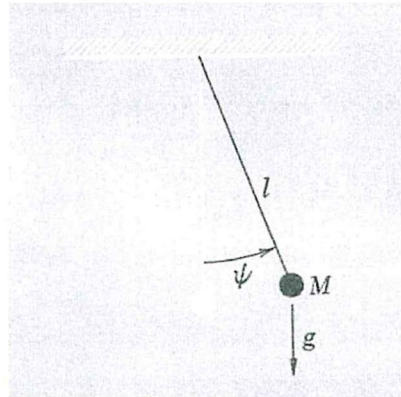


Figure 2.

QUESTION 5

[25]

- (a) IP and resistivity are useful in the vertical sounding and profiling methodology. To do this we need to assess the resistivity or conductivity of the given area. State three areas where we can use this methodology, in each case state the relative conductivity/resistivity of the sought after material compared to the host rock/soil. (6)
- (b) Draw a configuration of the Wenner and Schlumberger array. State the differences between the two and give any advantages if any of one array over the other. (2, 4)
- (c) If we need to see or go much deeper in our investigations, which set of electrodes (voltage or current) do we need to shift and in which fashion relative to the current or voltage electrodes? (4)
- (d) Discuss the usefulness of radiometrics in the exploration of mineral deposits and give an example of one such mineral/element/material. (5)
- (e) Distinguish between gamma spectrometers and scintillometers. (4)

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