THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MINING ENGINEERING

2022 - FIRST SEMESTER EXAMINATION

Second Year Mining Engineering

MN 211 – INTRODUCTION TO MINERALS ENGINEERING

DATE: **WEDNESDAY, 8th JUNE 2022**

ROOM: **MN001**

TIME: **8:20 A.M**

TIME ALLOWED: **3 HOURS**

INSTRUCTIONS TO CANDIDATES:

1. You have ten minutes to read through this paper. You **SHOULD NOT** begin writing during this period

2. There are **3 sections** to this paper. **Section 1: Geology, Section 2: Mining and Section 3: Mineral Processing.** You are to read instructions for each section before attempting the questions in each section.

3. **Section 1 (40%):** Mining (40%)

   Section II (30%): Geology has four parts (30%)

   - Part A Multiple Choice Questions (5 marks)
   - Part B True or False (5 marks)
   - Part C Short Answer Questions (10 marks)
   - Part D Long Answer Question(s) (10 marks)

   Section III (30%): Mineral Processing (30%)

4. **All answers must be written on the ANSWER BOOKLET provided.** No other written material will be accepted.

5. Answer **ALL** questions.

6. Write your **NAME** and **STUDENT NUMBER** clearly on the front page of the **ANSWER BOOKLET.**

7. Mobile phones, notes and notebooks are **NOT** allowed.

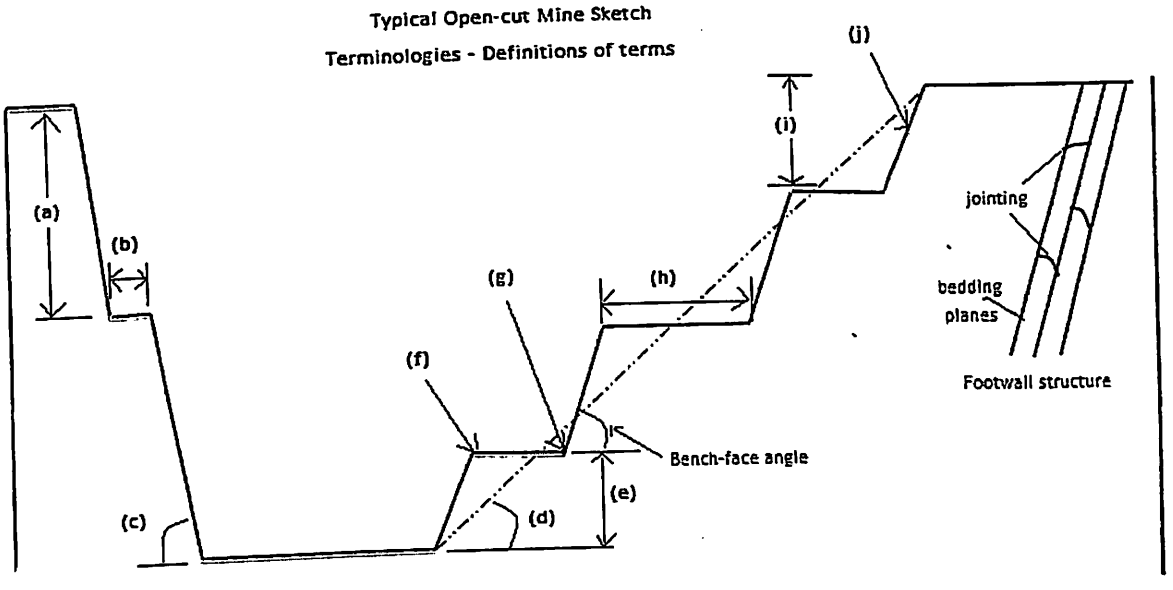
8. You MUST NOT LEAVE the room in the first hour.

SECTION 1: MINING (Total of 40 marks)

QUESTION 1: (15 marks)

I. In an open pit mine, there are different names of the profile of the pit. The diagram below captures a section view of a mine. **(5 marks)**

Fill in the blanks (a –j) with the correct names.



II. Compare and explain briefly so as to distinguish between the following Underground mining terms: **(4 marks)**

- **Draw-point** and **Ore-pass**
- **Cross-cut** and **Drift**

III. Compare and explain briefly so as to distinguish between the following drill and blast terms used in both open-pit and underground mining: **(6 marks)**

- **Burden** and **Spacing**
- **Detonator** and **Booster**
- **Bulk Explosives** and **Packaged Explosives**

QUESTION 2: (5 marks)

Compare and explain briefly with the of aid a **neat sketch** the **difference** between **Cut-and-Fill Stoping** and **Shrinkage Stoping** underground mining methods. **(5 marks)**

QUESTION 3: **(10 marks)**

The following data were provided from mine planning to determine the different stripping ratio:

- Waste Stripping Cost: $ 25/t of waste
- Ore Production Cost: $ 140/t of ore
- Gold Price: $ 1300 /oz
- Mill Recovery: 85 %
- Gold Grade: 6.5 g/t

#: Use 31.1 oz/g for converting ounces to grams.

Bench	Ore tonnes (t)	Waste tonnes (t)
1	6, 000	4, 500
2	13, 000	26, 000
3	19, 500	78, 000
4	26, 500	145, 000

I. Determine which **bench** will be the **pit limit** on the prevailing **economic conditions** and briefly **explain why**. Show all calculations to attain full marks. **(5 marks)**

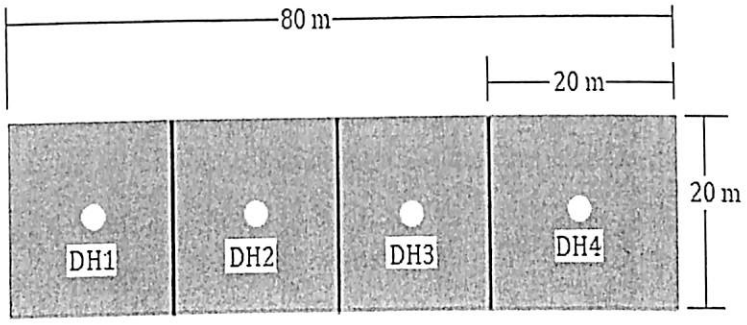
II. Calculate the **break-even cutoff grade (BECOG)** for **bench (#1)** and **bench (#2)** when given **6 % inflation** and **2% royalty.** **(5 marks)**

QUESTION 4: **(10 marks)**

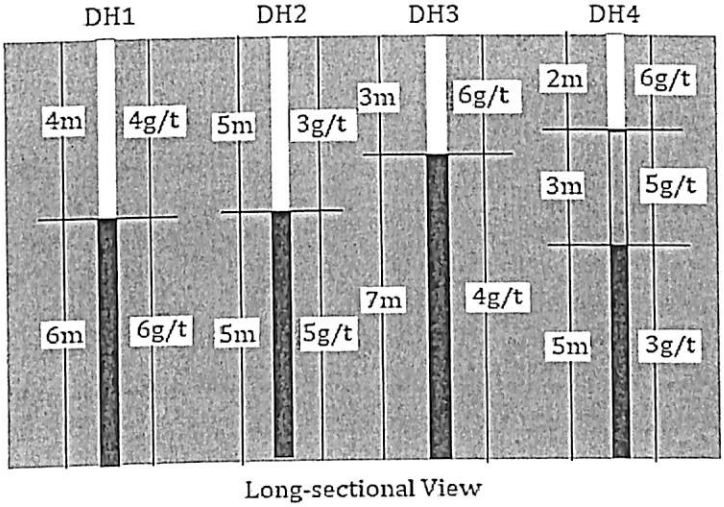
An ore block in the surface mining operation was planned and scheduled to be mined. The block tonnage and grade is required for grade control purposes.

Given information:

Four evenly spaced diamond drill-holes intersect the ore block. Given the dimension of the block: **20m (width), 80 m (length) and 20 m (height).** The rock density is **2.7 t/m^3**. Ore block dimensions are indicated on the figures provided.



Plan View



Long-sectional View

(Note//: Not to scale, sketch only -
DH - Drill hole)

i) Calculate the **designed tonnes** and **grade** of the whole ore-block. **(5 marks)**

ii) Calculate the **mined tonnes** and **grade** when given **20 % dilution** at **1.6 g/t** and **mine recovery of 85%.** **(5 marks)**

SECTION II: GEOLOGY

PART A MULTIPLE CHOICE **(5 MARKS)**

Questions 1-5, write the letter corresponding to the correct answer on your answer sheet

Q1. Dolomite is a .....

A. Terrigenous sedimentary rock
B. Foliated metamorphic rock
C. Chemical sedimentary rock
D. Non-foliated metamorphic rock

Q2. Which mineral sequence is arranged in order of decreasing hardness?

A. Quartz Feldspar Fluorite Apatite
B. Feldspar Apatite Quartz Fluorite
C. Feldspar Quartz Fluorite Apatite
D. Quartz Feldspar Apatite Fluorite

Q3. Which sentence gives the correct description of the rock Slate?

A. A foliated igneous rock that breaks into very thin layers, is very fine grained and is harder than shale
B. A non-foliated metamorphic rock that breaks into very thin layers. Is very fine gained and is harder than shale
C. A foliated metamorphic rock that breaks into very thin layers, is very fine gained and is harder than shale
D. A non-foliated igneous rock that breaks into very thin layers, is very fine gained and is harder than shale

Q4. The color left behind when a mineral is scratched against a porcelain plate is known as

A. Hardness
B. Lustre
C. Streak
D. Cleavage

Q5. Flow banded, crystalline, porphyritic, vesicular, glassy. These rock textures describe which type of rocks?

A. Sedimentary
B. Metamorphic and Igneous
C. Sedimentary and Metamorphic
D. Igneous

PART B TRUE or FALSE STAEMENTS **(5 MARKS)**

Questions 6-10; state whether each statement is TRUE or FALSE

Q6. Quartz has the following characteristics; colorless to milky white, hardness 7, lustre vitreous, streak white to colorless

Q7. Obsidian is a felsic volcanic rock

Q8. One of the characteristic features of metamorphic rocks is foliation

Q9. The composition of Rhyolite is described as silicic

Q10. Molten rock at depth within the earth is called lava

PART C SHORT ANSWERS (10 MARKS)

Questions 11-15 require a short explanation or description. Each question is worth 2 marks.

Q11. In what way is a mineral different from a rock?

Q12. How can you differentiate between a conglomerate and a breccia?

Q13. Explain the terms **aphanitic** and **phaneritic**

Q14. Briefly explain what a **foliated** metamorphic rock is and give an example.

Q15. What causes an earthquake?

PART D LONG ANSWER (10 MARKS)

Question 16-; read the questions carefully and answer accordingly.

Q16. i. Complete the following diagram using one of the following terms.

Sedimentary Metamorphic Intrusive Igneous Extrusive Igneous Sedimentation
Volcanic Eruption Heat and Pressure Weathering and Erosion Uplifting

ii. In your own words, briefly explain the diagram.