

**PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY**  
**DEPARTMENT OF MINING ENGINEERING**  
**SECOND SEMESTER FINAL EXAMINATION**  
**SECOND YEAR MINING AND MINERAL PROCESSING ENGINEERING**  
**MN 222 ECONOMIC GEOLOGY AND MINERALOGY**

**MONDAY 28th OCTOBER, 2020**

**TIME: 12.50 PM**

**TIME ALLOWED: 3 HOURS**

**INFORMATION FOR CANDIDATES**

1. You have 10 minutes to read through the Exam Paper. You **MUST NOT** begin writing during this time
2. Write your name, ID number and course clearly on the front page of the answer book provided
3. There are three sections to this examination; **Section A** is multiple choice questions and is worth one (1) mark each. **Section B** is short answer questions and marks for each question is indicated beside the question. **Section C** consists of longer answers and marks are indicated beside the questions
4. All Audio, mobile phones, electronic appliances etc. are prohibited in the exam room

**MARKING SCHEME**

1) MULTIPLE CHOICE QUESTIONS	Total 14 marks
2) SHORT ANSWER QUESTIONS	Total 45 marks
3) LONG ANSWER QUESTIONS	Total 41 marks

**SECTION A. MULTIPLE CHOICE (14 marks)**

1. Which of the following elements are common in bones? (1 mark)
  - (A). Ca and P
  - (B). P and Fe
  - (C). Mg and Ca
  - (D). Ca and Na
  - (E). Fe and Ca
  
2. Minerals are classified into groups or subdivisions based on their chemical compositions. How many groups are they classified into? (1 mark)
  - a) 8
  - b) 12
  - c) 10
  - d) 9
  - e) 6
  
3. At what temperature and depth is mesothermal (hydrothermal process) deposits occur? (1 mark)
  - A.  $< 50^{\circ}\text{C}$  and at shallow depth
  - B.  $300 - 500^{\circ}\text{C}$  and at great depths
  - C.  $50 - 150^{\circ}\text{C}$  and at shallow depths
  - D.  $150 - 300^{\circ}\text{C}$  and at intermediate depths
  - E.  $>150^{\circ}\text{C}$  and at shallow depths
  
4. What are the two important commodities in a Greisen deposit? (1 mark)
  - (A). Gold and Copper
  - (B). Molybdenite and Iron
  - (C). Silver and Nickel
  - (D). Tin and Tungsten
  - (E). None of the above

5. Minerals can be hammered out into thin sheets. The description best suits which properties of a mineral? (1 mark)
- A. Flexible
  - B. Ductile
  - C. Sectile
  - D. Malleable
  - E. Brittle
6. Which of these minerals DO NOT occur as pure elemental form in nature? (1 mark)
- A). Gold
  - B). Silver
  - C). Nickel
  - D). Copper
  - E). None of the above
7. Which Iron formation type is formed in the Paleoproterozoic era (2.5 – 1.9 Byr)? (1 mark)
- (A). Clinton type
  - (B). Algoma type
  - (C). Minette type
  - (D). Superior type
  - (E). All of the above
8. Which of these is an Iron bearing sulphide; (1 mark)
- (A). Galena
  - (B). Sphalerite
  - (C). Barite
  - (D). Marcasite
  - (E). None of the above
9. Which of the description below best describes "Concordant Ore body"? (1 mark)
- (A). Cut across layering in host rock
  - (B). Flat dipping of orebodies
  - (C). parallel to layering in host rock
  - (D) Horizontal mining of orebodies
  - (E). All of the above



10. The quality of gem diamond and ultimately their pricing is a function of their; (1 mark)
- (A). Clarity
  - (B). Size (carats)
  - (C). Colour
  - (D). cut
  - (E). All of the above
11. Which igneous rock types generally host the Rare Earth Element (REE) deposits? (1 mark)
- (A). Mafic and Ultra mafic rocks
  - (B) Felsic and Ultra mafic rocks
  - (C). Mafic and Felsic rocks
  - (D) Carbonatites and alkaline rocks
  - (E) All of the above
12. In which deposit type, is the deposit chemistry a function of the Oxidation state and the Degree of Crystallization , (1 mark)
- (A) Epithermal system
  - (B) Sedimentary Precipitates
  - (C) Greisen deposits
  - (D) Skarn deposits
  - (E) None of the above
13. In Cu Ni Sulphide deposit sulphides crystallize within the Fe-S-O phase relationship system. At which temperature will Pentlandite exsolve out from Pyrrhotite (1 mark)
- (A) 1160°C
  - (B) 1120°C
  - (C) 1000°C
  - (D) 915°C
  - (E) None of the above
14. Hydrated aluminum silicate minerals which have a flakey habit and a sheet like structure are generally collectively referred to as; (1 mark)
- A) Oxide minerals
  - B) Clay minerals
  - C) Hydroxide minerals
  - D) Felsic minerals
  - E) Mafic minerals

**SECTION B. SHORT ANSWERS (45 marks)**

1. Weathering of minerals in a rock is a reversal of which reaction (1 mark)
2. Name at least two polymorphs with this chemical formula  $Al_2SiO_5$ ; (2 marks)
3. State the modes of formation of Orthomagmatic ores (6 marks)
4. Crystals assume various geometric shapes dependent on the arrangement or ordering of their atomic structure and the physical and chemical condition under which they grow during the process of crystallization. State six (6) crystal systems that crystals are classified into; (6 marks)
5. In Igneous deposits, list the four mechanism that is critical to Sulphur Saturation or in other words helps the concentration of sulphur to form mineral deposits (4marks)
6. List the four depositional facies of Iron formation types and their dominant minerals. (8 marks)
7. List the 3 main igneous rock types that host the Orthomagmatic deposits and under each rock type list at least one (1) commodity or ore that it hosts. (6 marks)
8. Nickel copper sulphide deposits are mainly of the syn-volcanic and cratonic type. Under the cratonic type state the two subclasses. (2 marks)
9. List the chemical formula for each of these minerals and state which mineral group are they classified or grouped under; (10 marks)
  - A. Stibnite
  - B. Ilmenite
  - C. Malachite
  - D. Barite
  - E. Willemite

**SECTION C. LONG ANSWERS QUESTION (41 marks)**

1. Define the terminology; (10 marks)

- A. Orthomagmatic deposit-
- B. epigenetic-
- C. syngenetic -
- D. ore mineral-
- E. komatite –

2. What are the three (3) end members of feldspar? Write the mineral names and its chemical formula. (6 marks)

Mineral

Chemical Formula

.....  
.....  
.....

.....  
.....  
.....

3. In terms mineral deposit classification, list at least five (5) characteristics of Epithermal systems and Porphyry Cu Au systems generally found in PNG. (10 marks)

**Epithermal Systems**

- o 1
- o 2
- o 3
- o 4
- o 5

**Porphyry Cu Au System**

- 1
- 2
- 3
- 4
- 5

4. State the style of deposit, the main commodities and at least 1 ore mineral that is associated with the commodities that is produced in the mines in PNG listed below (15 marks)

Mine	Style of deposit	Commodity	Ore Mineral
Hidden Valley			
Ramu (Kurumbukari)			
Lihir			
Porgera			
Ok Tedi			

**THE END**