

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

MINING ENGINEERING DEPARTMENT

2022 FIRST SEMESTER EXAMINATION

THIRD YEAR MINERAL PROCESSING ENGINEERING

MP315 – MINERAL TECHNOLOGY II

DATE: FRIDAY 3 JUNE

TIME: 12:50 P.M.

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES:

1. You have ten (10) minutes to read the paper. You **MUST NOT** begin writing during this time.
2. Attempt **ALL** questions. Write all answers in the answer booklet provided.
3. Write your **NAME** and **NUMBER** clearly on the **ANSWER BOOKLET**. Do this **NOW**.

Marking scheme

All question carry equal marks (20 Marks). Total mark is 100.

QUESTION ONE

- (A) What is Chromite? Describe this industrial mineral and its application and in which industry. Name two of this industries and the products that are made using this industrial mineral.
- (B) Name two different problems that affect the glass quality. Describe them and explain how these problems can be minimized during glass manufacturing operation.

QUESTION TWO

- (A) Name the four different mineral phases that exist in the cement clinker and describe them in detail.
- (B) There are five very important qualities that the cement customer expects from the cement you manufactured. Name two of these quality requirements and explain them.

QUESTION THREE

Below is the clinker quality certificate. Use this certificate to calculate the potential phase composition and the total clinker percentage by weight using Bouge's Equation.

Quality Certificate

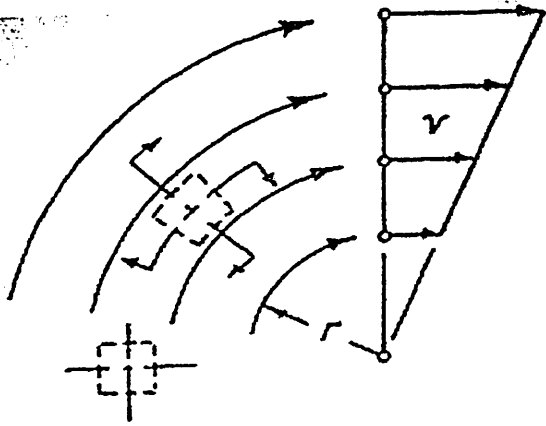
Chemical Analysis

Silicon Dioxide	(SiO ₂),	22.0 %
Aluminum Oxide	(Al ₂ O ₃),	5.8 %
Ferric Oxide	(Fe ₂ O ₃),	3.6 %
Calcium Oxide	(CaO),	65.8 %
Magnesium Oxide	(MgO),	1.3 %
Sulphur Trioxide	(SO ₃),	0.5 %
Sodium Oxide	(Na ₂ O),	0.24 %
Potassium Oxide	(K ₂ O),	0.41 %
Equivalent Alkalies	(Na ₂ O+0.658K ₂ O),	0.51 %
Loss on Ignition	(ig.loss),	0.3 %
Insoluble residue	(insol),	0.1 %
Chloride	(Cl),	0.003 %
Free Calcium oxide	(F.CaO),	1.0 %

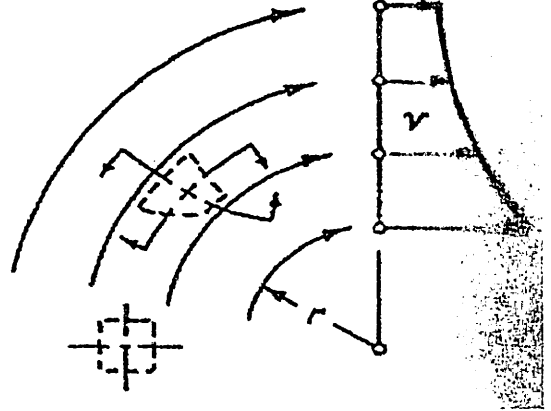
This clinker is suitable for the production of Ordinary Portland Cement according to ASTM C-150, 1997 Type I.

QUESTION FOUR

(A) Particles encounter various types of fluid motion in a pipe. Name and describe the two flows illustrated below.



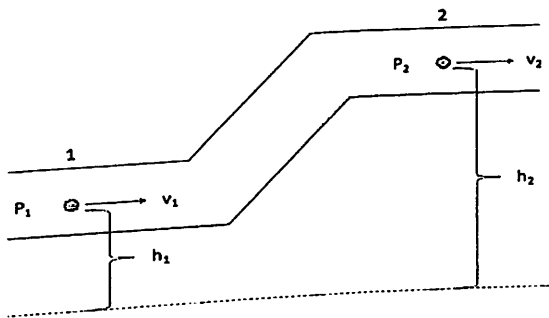
(i)



(ii)

(B) To maintain constant flow in a pipe where only the height changes and not the diameter, one variable has to increase while the other decreases. In this case, height increases while pressure decreases due to height. Find P_1 if P_2 decreases to 1.52 ATM.

- Given:
- $h_1 = 5 \text{ m}$ above reference point
 - $h_2 = 10 \text{ m}$ above reference point
 - $v_1 = 2 \text{ m/s}$
 - $v_2 = 2 \text{ m/s}$
 - $P_1 = ?$
 - $P_2 = 1.52 \text{ ATM}$



$$p + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$$

(C) Sediment in a form of silt from the Mineral Processing Plant is delivered into a recovery pond. Determine the type of flow and the time required for the sediment to settle 50 cm. Medium is water.

- Given:
- $d = 5 \times 10^{-4} \text{ mm}$
 - $\eta = 1 \times 10^{-3} \text{ kgm}^{-1}\text{s}^{-1}$
 - $P_s = 2650 \text{ kgm}^{-3}$

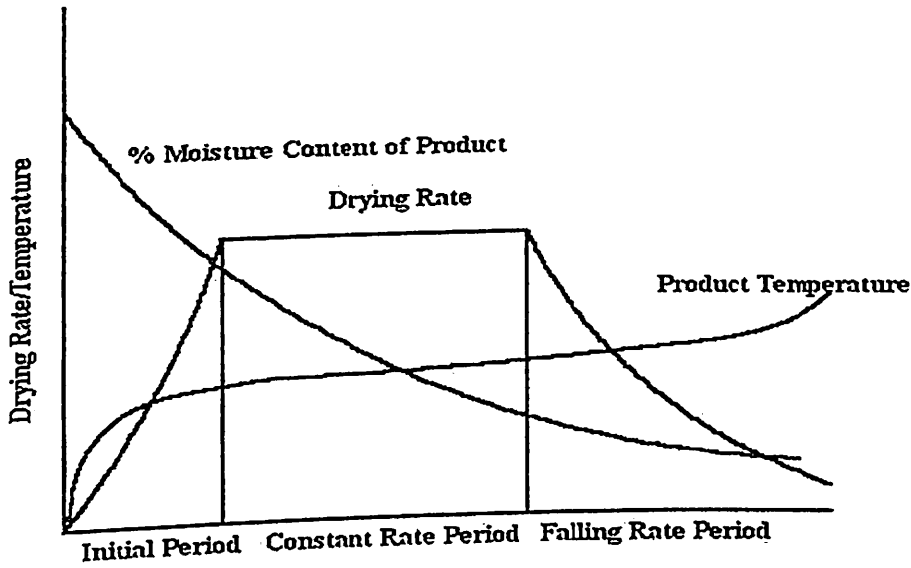
QUESTION FIVE

(A) Name and discuss any two factors affecting the rate of filtration.

(B) Discuss the operation of a Plate and frame filter press.

(C) Industrial pressure filters use hydraulic pressure as a driving force to generate high-pressure drop.
Discuss the advantages of high-pressure drops.

(D) The representative curve below describes the drying characteristics for a product at specific temperature, velocity and pressure conditions. Discuss the three drying periods or phases at which drying occurs.



(E) Using the Psychrometric chart below at a Dry bulb temperature of 302 °K and 40% Relative humidity, determine the following parameters:

- (i) Wet bulb temperature (°F)
- (ii) Dew point temperature (°F)

Temperature conversion:

$$t_K = t_C + 273.15$$

$$t_C = t_K - 273.15$$

$$t_F = \frac{9}{5}t_C + 32$$

$$t_C = \frac{5}{9}(t_F - 32)$$

