PART A / *BAHAGIAN A*

(1) (a). Table 1 presents the data of Lucky Copper Mine using the Polygonal average method. Assume that the tonnage factor (TF) was reported at 4.2 m^3/ton for all polygonal samples above, **calculate**:

Jadual 1 menunjukkan data kaedah purata Polygonal Lombong Cuprum Lucky'. Andaikan faktor tanan (TF) adalah 4.2 m^3/tan bagi kesemua sampel polygonal di atas, ***kirakan****:*

(i) The total tonnage of ore
Jumlah tan bijih

(6 marks/*markah*)

(ii). The average grade of Cu.
Gred purata Cu.

(2 marks/*markah*)

(ii) Assuming the production of the mine was set at 100,000 ton/year, determine the mine life.

Andaikan kadar pengeluaran lombong ditetapkan pada 100,000 tan/tahun, kira hayat lombong ini.

(2 marks/*markah*)

Note: Fill in the Table 1 and partially marks are given for the table.

Nota: Isikan Jadual 1 dan sebahagian markah diberikan untuk jadual tersebut.

Table 1: Ore reserves for Lucky Copper Mine

Jadual 1: Rizab bijih Lombong Kuprum Lucky

Polygon	Area, A (m^2)	Thickness, T (m)	Volume, (m^3)	Tonnage factor, TF (m^3/ton)	Ton Ore (ton)	Grade (%Cu)	Ton %
P1	5330	150				0.71	
P2	4800	260				0.69	
P3	6100	230				0.85	
P4	3760	135				1.34	
P5	4450	160				1.00	
P6	7610	200				0.95	

(b). Brieftly, **commen**t on these topics:

*Secara ringkas, **komen** berkenaan topik berikut:*

(i). Stemming (T)

Pemadatan (T)

(3 marks/ *markah)*

(ii). Burden (B)

Beban (B)

(3 marks/ *markah)*

(iii) Inclined blasthole

Lubang Letup condong

(4 marks/ *markah)*

(2) (a) **Discuss** on these topics related to the life stages of a mine:

Bincangkan *berkenaan tajuk berikut yang berkaitan dengan fasa-fasa hayat lombong:*

(i) Prospecting
Pencarigalian

(4 marks/*markah*)

(ii) Exploration
Penjelajahan

(4 marks/*markah*)

(iii) Development
Pembangunan

(4 marks/*markah*)

(iv) Exploitation
Eksploitasi

(4 marks/*markah*)

(b). **Comment** on the possible impacts of unsustainable mining activities as follows:

Komen *berkenaan kemungkinan impak daripada aktiviti perlombongan yang tidak selari seperti berikut:*

(i) Environmental and land used impacts
Impak alam sekitar dan penggunaan tanah

(2 marks/ *markah)*

…5/-

(ii) Accidents and health hazards
Risiko kesihatan dan kemalangan

(1 marks/ *markah)*

(iii) Economic – Political – Social – psychological impacts
Impak ekonomi-politik-sosial-psikologi

(1 marks/ *markah*)

(3). (a). The first process that most ores or minerals undergo after they leave any mine, is mineral processing. Explain briefly the principle and the importance of mineral processing in the mining industry.

Hampir kesemua bijih atau mineral akan melalui proses yang pertama selepas dilombong iaitu pemprosesan mineral. Terangkan dengan ringkas konsep pemprosesan mineral dan kepentingan pemprosesan mineral dalam industri perlombongan.

(4 marks/*markah*)

(b). **Describe** the concept of the magnetic separation using a suitable diagram.

Terangkan konsep pemisahan magnetik dengan menggunakan gambarajah yang bersesuaian.

(6 marks/markah)

(c). The heavy mineral sands contain magnetite, ilmenite, zircon, monazite, and rutile. **Draw** a flow chart to isolate each of these minerals and **explain clearly** the unit operations used.

Pasir mineral berat mengandungi magnetit, ilmenit, zirkon, monazit, dan rutil. Lukis carta alir untuk mengasingkan setiap mineral ini dan terangkan dengan jelas setiap unit operasi yang digunakan.

(10 marks/markah)

PART B / *BAHAGIAN B*

(4) (a). A porphyry deposit is to be mined using underground block caving methods at a cost of RM 3.00/ton of ore. If the same deposit is set to be mine using open pit mining, the costs are RM 0.40/ton ore and stripping costs of RM 0.50/ton of waste respectively.

Calculate the stripping ratio (SR). **Comment** on the best selection of mining method to be choose based on the SR value.

Satu endapan porphyril akan dilombong menggunakan kaedah bawah tanah perampakan bongkah pada kos RM 3.00/ton bijih. Jika endapan yang sama dilombong menggunakan kaedah perlombongan lelubang dedah, kos diperlukan adalah RM 0.40/tan bijih dan kos penarahan pada RM 0.50/ton buangan.

***Kirakan** nisbah penarahan (SR). **Komen** berkenaan kaedah perlombongan terbaik berdasarkan nilai SR tersebut.*

(6 marks/*markah*)

(b). **Define** on the Cut off Grade (COG). **Comment** on the important of COG to the mining operation and financial sustainability of a mine.

Takrifkan *gred penggalan (COG).* ***Komen*** *berkenaan kepentingan COG terhadap operasi dan kelestarian kewangan sesuatu lombong.*

(6 marks/*markah*)

(c). Briefly **discuss** on the following topics related to the selection of suitable vehicle and equipment in a quarry or mine.

Secara ringkas, ***bincangkan*** *topik-topik berikut yang berkaitan dengan pemilihan kenderaan dan peralatan di dalam kuari atau lombong*

(i) Performance factors
Faktor prestasi

(2 marks/*markah*)

(ii) Design factors
Faktor reka bentuk

(2 marks/*markah*)

(iii) Support factors
Faktor sokongan

(2 marks/*markah*)

(iv) Cost factors
Faktor kos

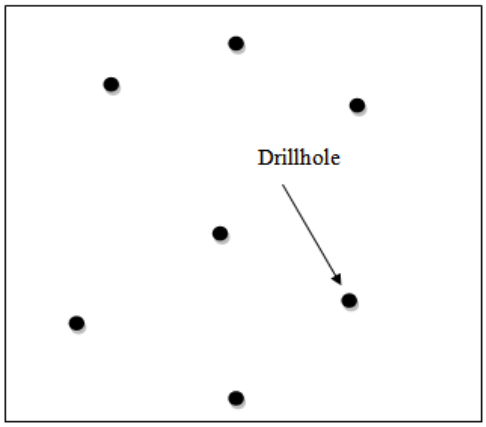
(2 marks/*markah*)

(5) (a). **Explain** the reasons in conversion of surface mine into underground mine.

Jelaskan *sebab-sebab pertukaran lombong permukaan kepada lombong bawah tanah.*

(8 marks/*markah)*

(b).



Rajah 1: Drillhole pattern/ Corak lubang gerudi

By the aid of a sketch, **explain** the traditional procedures (polygonal method) for reserve estimation by areas of influence based on the drillholes pattern as given in the Figure 1.

Dengan bantuan lakaran, ***terangkan*** *prosedur tradisional (kaedah poligon) untuk tujuan penganggaran rizab kawasan pengaruh berdasarkan kedudukan lubang gerudi seperti yang ditunjukkan dalam Rajah 1.*

(6 marks/*markah)*

(c) **Discuss** on the methods to increase the productivity in quarry or mining operation

Bincangkan *kaedah-kaedah meningkatkan produktiviti di dalam operasi pengkuarian atau perlombongan.*

(6 marks/*markah*)

(6). (a). Sketch a flow sheet of mineral processing circuit in general and describe of the unit processes involved in mineral processing.

Lakarkan lembaran aliran umum litar pemprosesan mineral dan huraikan unit proses yang terlibat di dalam proses pemprosesan mineral.

(6 marks/*markah*)

(b). A concentrator is fed 1000 t h^{-1} of ore assaying 10% PbS. It produces a concentrate assaying 80% PbS and a tailings assaying 0.19% PbS. Calculate the flow rates of the tailing and concentrate streams in t h^{-1}.

Bijih dimasukkan ke dalam sebuah konsentrator dengan kadar suapan 1000 ton/jam yang mempunyai nilai gred bijih sebanyak 10% PbS. Ia telah menghasilkan konsentrat yang mempunyai nilai gred bijih sebanyak 80% PbS dan hampas sebanyak 0.19% PbS. Cari kadar aliran hampas dan konsentrat dalam ton/jam.

(6 marks/*markah*)

(c). A large copper concentrator treats 50,000 tonnes of copper ore per day to produce 1250 tonnes of concentrate (Please refer to the block diagram below). If the head and concentrate copper grade are 0.95% and 32.5% respectively **calculate:**

Kosentrator kuprum yang besar telah merawat 50,000 tan bijih kuprum sehari untuk menghasilkan 1250 tan kosentrat (Sila rujuk Gambarajah 1 di bawah). Jika gred kuprum dan kosentrat ialah 0.95% dan 32.5% masing-masing, ***hitung****,*

(i) The mass and grade of tailing
Jisim dan gred hampas

(ii) The mass of copper lost to tailing
Jisim kuprum yang hilang di hampas

(8 marks/*markah*)

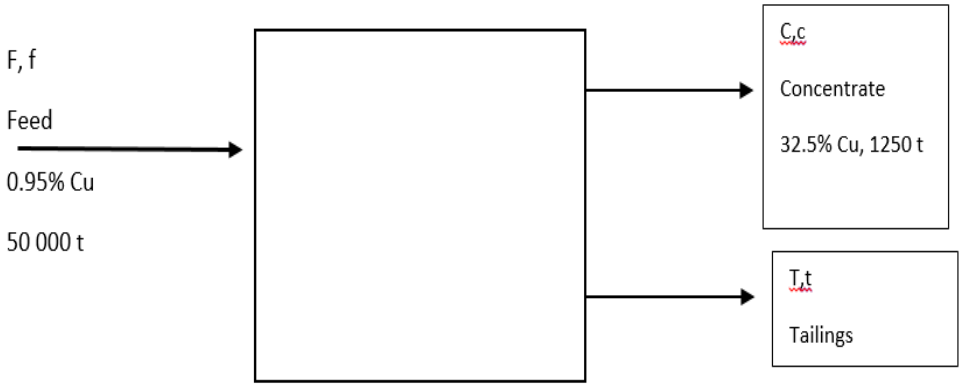


Figure 1 Block diagram of copper mass balance.
Rajah 1 Rajah blok bagi imbangan jisim kuprum.

(7) (a). Describe FIVE (5) pre-treatment processes in extractive metallurgy.

Terangkan LIMA(5) proses pra-rawatan dalam metalurgi ekstraktif.

(5 marks/*markah)*

(b). Pyrometallurgical processes are carried out at elevated temperatures (usually between 800 and 1600 ^{o}C) in the absence of an aqueous phase. Describe TWO(2) most important pyrometallurgical extraction processes.

Proses pirometalurgi dijalankan pada suhu yang tinggi (biasanya di antara 800 dan 1600 ^{o}C) tanpa kehadiran fasa akueus. Terangkan DUA(2) proses pirometalurgi yang paling utama.

(3 marks/ *markah*)

(c). What are the basic requirements of solvents or leaching reagents to be used in the hydrometallurgical process.

Apakah syarat-syarat asas yang diperlukan sebagai pelarut atau reagen larutan yang digunakan dalam proses hidrometalurgi.

(6 marks/ *markah*)

(d). Explain the advantages and disadvantages of hydrometallurgical and pyrometallurgical processes.

Jelaskan kebaikan dan keburukan proses hidrometalurgi dan pirometalurgi.

(6 marks/ *markah*)

-oooOooo-