

**REPUBLIC OF SOUTH AFRICA  
DEPARTMENT OF MINERALS AND ENERGY  
EXAMINATION FOR THE MINE SURVEYORS CERTIFICATE OF COMPETENCY**

DATE: 12 October 2007 (Friday)  
TIME: 08h30 to 11h30 (3 Hours)

TOTAL MARKS 100  
TO PASS 50

**SUBJECT: MINING ECONOMICS 1**

**Notes:**

- (1) All steps must be shown.
- (2) Checks must be shown, since they carry marks.

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**[7 Questions, 3 Pages]**

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**QUESTION 1**

An ore in-situ has a density of  $2,75 \text{ t/m}^3$ . What is the density when broken if its porosity is 40 % and the moisture content 6 %?

**[5 Marks]**

**QUESTION 2**

A mine is investigating the building of a surface sorting plant. Calculate what percentage of surface sorting could be expected from each stope, given the following average sample widths measured underground at a stope face.

	Stope 1	Stope 2
Reef width (cm)	15	122
Waste width (cm)	76	30
Stope width (cm)	91	152
Waste fines (%)	40	40

Assume that in each case 10 % of waste is unavoidably attached to the reef and is not sorted, and that another 10 % escapes sorting through error. No sorting of waste takes place underground.

**[15 Marks]**

### QUESTION 3

Discuss what is meant by the terms over- or undermining when applied to the ore reserve mining position? Also discuss in what context an ore reserve mining factor would be applied.

[10 Marks]

### QUESTION 4

The average mining height of a working section of a colliery will be reduced from 3,76 metres to 2,75 metres by undercutting. The following sampling heights are given.

	Heights from hanging-wall down (m)	Calorific value (MJ/kg)
Sample 1	1,22	24,8
	1,30	25,7
	1,17	27,1
Sample 2	1,74	25,9
	1,83	26,9
Sample 3	1,37	25,5
	0,91	26,7
	1,52	27,1
Sample 4	1,97	25,9
	2,01	26,9

Determine:

- (a) The calorific value of the coal in this section at a mining height of 3,76 metres. (5)
- (b) The calorific value of the coal in this section at a mining height of 2,75 metres. (15)

[20 Marks]

### QUESTION 5

Construct a histogram, a frequency distribution curve and a cumulative frequency distribution curve, based on the following gold values:

55; 15; 280; 143; 1 350; 386; 95; 4 787; 203; 275; 615; 193; 64; 892; 362; 102; 163; 205; 488; 136; 72.

Describe the shapes of the curves and comment whether they are typical of a gold ore.

[15 Marks]

## QUESTION 6

The average grade of a kimberlite diamond mine (volcanic pipe) is expressed in carats per hundred tons (cpht). The average sales value of the product (carats) is expressed in US dollar per carat (US\$/ct). The economic value of a diamond mine is often expressed as US dollar per ton of kimberlite in the ground (US\$/t).

- (a) Derive the mathematic relationship between grade (cpht), sales value (US\$/t) and economic value (US\$/t); (4)
- (b) If a mine is said to contain a grade of 17 cpht at an average value of US\$70/ct, calculate its economic value (in US\$/t); (4)
- (c) If the in-situ resource contains 4 million tons, calculate the total potential economic revenue in the ground (in US\$); (3)
- (d) If total mining and treatment cost is US\$18/t, will the mine mentioned in question 6 (b) make a profit? (4)

[15 Marks]

## QUESTION 7

A drilling programme for delineation and core sampling purposes has indicated the presence of two adjacent copper ore bodies Cu 1 and Cu 2. The extents of the ore reserve are known as follows:

- Cu 1: 55 million tons at an average grade of 2 % copper;
- Cu 2: 40 million tons at an average grade of 5 % copper.

The ore bodies will be mined in proportions equal to their estimated mass to ensure simultaneous total extraction. The ore extracted will be sent to a combined treatment plant. The following assumptions (resource to reserve conversion factors) apply:

- (1) Maximum mining extraction rate is 80 %;
- (2) Dilution by external and internal waste at zero grade, not in reserve, is 10 %;
- (3) Plant recovery efficiency is 90 %.

The required rate of production of fully refined copper is 7 000 tons per month.

Calculate:

- (a) The life of the mine (months); (5)
- (b) Grade of ore to plant head feed (% copper); (5)
- (c) Annual depletion of the diluted ore reserve (tons per annum); (5)
- (d) Monthly tonnage of ore to be mined from each ore body (tons per month). (5)

[20 Marks]

[TOTAL MARKS 100]