

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

DATE: Friday 13 October 2006  
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.
- (3) Assume RD of 2.78 t/m<sup>3</sup> for in-situ rock and 1.67 t/m<sup>3</sup> for broken rock

**START OF EXAMINATION PAPER**

**[6 Questions, 4 Pages]**

**QUESTION 1**

Given the following information, calculate the stopping pay limit for a gold mine:

Gully waste	6 % of ore broken at stope face
Development tons to mill	9 000 tons at 6,0 g/t
Block factor	95 %
Discrepancy (shortfall)	6 % of tons hoisted
Surface sorting	7 % of ore hoisted at 0,5 g/t
Tons milled	300 000 tons
Mine call factor	76,0 %
Recovery factor	95,0 %
Planned working cost	ZAR 473 per ton treated
Price of gold	ZAR 142 300 per kg
Mass conversion rate	1 oz. = 31,103 48 g
Currency exchange rate	ZAR 7,16 per USD

The balance of the tonnage is obtained from the stope faces.

[25 Marks]

## QUESTION 2

The monthly report of operations of a gold mine showed that ore reserve blocks, which were estimated at a value of 7,00 g/t at a block width of 100,0 cm actually averaged 6,00 g/t at a width of 106,0 cm when stoped. Ore mined from unblocked sources (Not in Reserve or N.I.R.) produced 40 000 tons at a value of 5,60 g/t and a stoping width of 105,0 cm.

Other sources of ore before sorting were:

Source	Mass (t)	Value (g/t)
Ore from reclamation	25 000	8,00
Ore from development	10 000	5,00
Waste sorted and packed underground	5 000	0,50
Ore from stockpile sent to the sorting station	5 000	6,00
Waste sorted in the plant at 7.00 %	-	0,30
Tonnage discrepancy (excess)	10 000	nil

The monthly tonnage milled was 330 000 tons at a recovery factor of 97 %.

Calculate:

- The total area of reef stoped during the month, expressed in square metres (m<sup>2</sup>) (5)
- The stope tramming width, expressed in centimetres (cm) (5)
- The block factor for the month (5)
- The content of gold produced for the month, expressed in grams (g) (5)
- The residue value, expressed in grams per ton (g/t) (5)

[25 marks]

## QUESTION 3

The following example represents the ore reserve summary of a section of a mine. It is required to extract a total of 212 kilograms of gold from this section. To achieve this call, an extra source, block E, must be brought into production, with qualities as shown below.

Block	Area on plan (m <sup>2</sup> )	Dip (deg)	Stope width (cm)	Stope value (g/t)
A	2 600	12,0	110,0	11,00
B	1 900	16,0	100,0	10,00
C	1 400	14,0	100,0	9,00
D	1 200	11,0	90,0	7,00
E	?	7,0	90,0	12,00

**QUESTION 3 CONTINUED**

Calculate:

- (a) The area on plan to be mined from block E to satisfy the condition. (2)
- (b) The total inclined area, expressed in square metres (m<sup>2</sup>). (1)
- (c) The total rock mass contained within this section, expressed in tons (t). (1)
- (d) The weighted average block width, expressed in centimetres (cm). (2)
- (e) The weighted average block value, expressed in grams per ton (g/t). (2)
- (f) The weighted average dip, expressed in degrees. (2)

[10 Marks]

**QUESTION 4**

An underground mine works two reefs. It is assumed that both reef horizons A and B are fully developed and will be commenced and exhausted simultaneously.

Geological and mining parameters:

Item	Reef A	Reef B
Area on dip	6 200 000 m <sup>2</sup>	19 000 500 m <sup>2</sup>
Average stoping width	120 cm	100 cm
Payability (reserve)	60%	90%
Percentage unpay mined (resource)	10%	15%
Geological loss (faults, dykes, sills etc)	15%	20%
Estimated stoping value	8,00 g/t	13,00 g/t

Treatment factors:

Sorted on surface at nil value	10 000 tons p.m.
Tons milled	300 000 tons p.m.
Mine Call Factor and Recovery Factor combined	90%

Calculate:

- (a) The tonnage proportion to be mined from each reef horizon, expressed as a percentage of total mining production. (5)
- (b) The life of the mine, in months. (5)
- (c) The average recovery grade, in grams per ton (g/t). (5)

[15 marks]

### QUESTION 5

What questions would you ask if tasked with a grade control investigation on your underground gold mine? Motivate your answers and discuss issues to be addressed in the following environments:

- (a) At the face (3)
- (b) In the back areas (3)
- (c) In the gullies (3)
- (d) In ore passes (3)
- (e) In the shaft system (2)
- (f) On surface (2)
- (g) In the treatment plant (2)

For the purposes of this examination you must assume that your sampling, assaying and estimation procedures are sound and require no attention.

[15 marks]

### QUESTION 6

A mine sells a waste rock dump to a stone crushing company, subject to the following conditions: all fines, amounting to 12% of total tonnage, and hand picked reef amounting to 2% of total tonnage will be delivered to the gold treatment plant. The balance of tonnage must be paid for by the stone crushing company at a rate of R2,00 per ton. Labour for the reef picking plant will be supplied by the mine.

Calculate the monthly profit made by the mine, assuming the following conditions:

Tons removed from the dump	50 000 tons p.m.
Value of the fines	1,50 g/t
Value of the hand picked reef	5,00 g/t
Plant residue value	0,20 g/t
Mass conversion rate	1 oz. = 31,103 48 g
Price of gold	ZAR 142 300 per kg
Currency exchange rate	ZAR 7,16 per USD
Milling cost per ounce	\$ 210 per ounce recovered
Cost of hand picking per ton	ZAR 200 per ton picked

[10 marks]

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**END OF EXAMINATION PAPER**

**[Total 100 marks]**