

National Exams May 2016

04-Geol-B8, Resource Economics and Valuation

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK EXAM.
Any non-communicating calculator is permitted.
3. FOUR (4) questions constitute a complete exam paper.
The first four questions as they appear in the answer book will be marked.
4. Each question is of equal value.
5. Most questions require mathematical solutions. Clarity and organization of the steps involved in solving the problems are important.

Marking Scheme

1. 25 marks
2. i) 15 marks; ii) 10 marks
3. (i) 10 marks; (ii) 10 marks; (iii) 5 marks
4. 25 marks
5. i) 15 marks; ii) 10 marks
6. 25 marks

(25) Question 1

An opportunity has arisen to purchase a net smelter revenue royalty interest in an existing mining operation. A 3% net smelter royalty on the project has been offered to GeoRoyalties at a cost of \$20 million dollars.

Based on the following deposit information, should GeoRoyalties purchase the royalty interest? What is the minimum royalty rate they should accept for their \$20 million investment?

Recoverable Reserves	20.0 million tonnes
Annual Capacity	2.0 million tonnes of ore
Grades	2.5% Cu, 1.0 grams/tonne Au
Processing Recoveries	Cu – 90%; Au – 75%
Metal Prices	Cu - \$3679/tonne; Au - \$15/gram
Annual Tax Payments	\$15 million
Copper Concentrate Grade	30% Cu
Unit Deduction	2.0%
Refining Charge	\$200/tonne Cu
Treatment Charge	\$100/tonne of concentrate
Gold Credit Terms: pay for 93.3 % of gold in copper concentrate less one gram	
Cost of Capital	8%

Net Smelter Return Conditions for Copper Concentrate

$$NSV = \frac{(M - D)(P - r)}{100} - T + C$$

Where:

NSV = net smelter value per tonne of concentrate

M = concentrate grade

D = unit deduction

P = copper price (\$/tonne Cu)

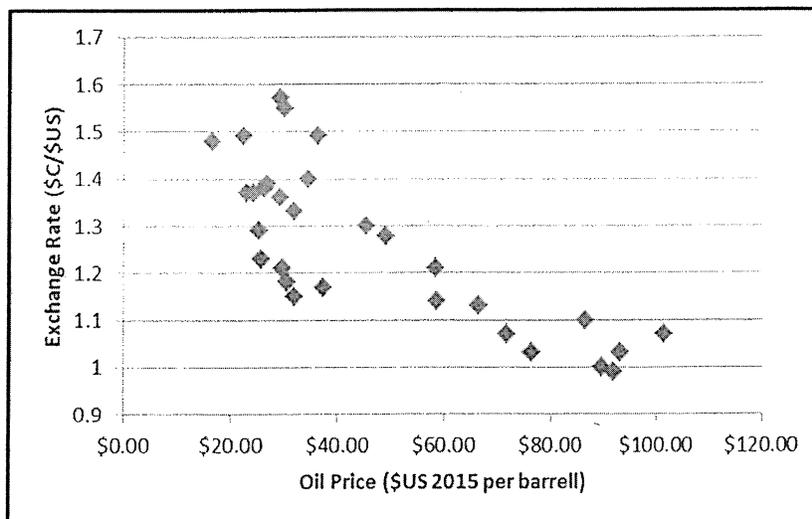
r = refining charge (\$ per tonne Cu)

T = treatment charge (\$ per tonne of concentrate)

C = gold credit

(25) Question 2

- (i) The *short-term cyclical nature* of mineral commodity prices traded in competitive markets is reflected in the most recent 10-12 year period. Explain the particular characteristics of mineral supply and demand that cause this cyclical phenomenon with focus on the most recent cycle.
- (ii) The graph below shows a scatter plot of the last 20 years of oil prices in constant 2015 US dollars and the exchange rate between the US and Canadian dollar. Comment on this relationship and the implications for Canadian petroleum producers in the context of the broader supply and demand conditions discussed in (i) above.



(25) Question 3

- i) Explain the concept of cut-off grade.
- ii) What effect do variations in cut-off grade have on the quantity and quality of ore resources and reserves in a mineral deposit? Compare and contrast exploration stage projects with mining projects.
- iii) Discuss the concept and implications of cutting or capping individual grade assays when determining tonnage and grade values for reserves.

(25) Question 4

A mining company has the opportunity to acquire a 10 million tonne copper deposit for a total cost of \$30 million paid in equal instalments at the end of the first year and end of the second year of development. These payments are treated as extra preproduction capital expenditures for tax purposes. The copper deposit is suitable for open pit mining producing a copper concentrate for export. Project specifications are as follows:

<i>Annual Ore Capacity</i>	<i>2 million tonnes</i>
<i>Average Ore Grade</i>	<i>2% Cu</i>
<i>Processing Recovery</i>	<i>90.1 %</i>
<i>Net Smelter Return</i>	<i>75.0 %</i>
<i>Copper Price</i>	<i>\$5000 per tonne of Cu</i>
<i>Operating Costs</i>	<i>\$35.00 per tonne of ore</i>
<i>Preproduction Capital Expenditures</i>	<i>\$100 million total not including acquisition (spread evenly over 2 years)</i>
<i>Depreciation</i>	<i>20% per year beginning in first year of production.</i>
<i>Taxation</i>	<i>40% of taxable income (revenue less operating costs)</i>

If the company requires a 15% rate of return on investment, would you recommend the acquisition of the deposit?

(25) Question 5

A particular 10,000 tonne block of mineralization in an underground copper gold mine has been estimated to contain an average of 1.4% Cu, 3 g/t Au and 50 g/t Ag. Information concerning the marketable products in the ore is shown below.

	<i>Mill Recovery (%)</i>	<i>Market price (U.S. \$)</i>	<i>Net Smelter Return (%)</i>
<i>Copper</i>	<i>92</i>	<i>5500 / tonne</i>	<i>75</i>
<i>Gold</i>	<i>50</i>	<i>35 / g</i>	<i>80</i>
<i>Silver</i>	<i>40</i>	<i>0.50 / g</i>	<i>70</i>

The mining method used to extract the ore has a recovery factor of 90 % and results in 15 % dilution by waste material which averages 0.20% Cu, 0.25 g/t Au and 2.0 g/t Ag.

- i) Determine the mineable tonnage and grades of the block.**
- ii) What is the grade in terms of copper equivalents?**

(25) **Question 6**

Describe in adequate detail the process and methodologies appropriate for the valuation of earlier-stage mineral projects. Focus on the strengths and weaknesses of the various methods as projects move through the supply pipeline from exploration targets to the various stages of resource and reserve determination up to the point of a pre-feasibility study.