

**CHE 477 – Problem Set 3****Due: Wed 9/27 11:59pm****Late submissions not accepted because solutions will be posted before Exam 2 (9/29)**

1. Estimated costs for a proposed new 150,000 barrel per day petroleum refinery are described as follows, where all numbers given are in millions of dollars. At the beginning of the project, land is purchased for \$2. The  $FCI_L$  is spent over a 5 year construction period, totaling \$5,700, with \$1,710 in year 1, \$1140 in each of years 2-4, and \$570 in year 5. Working capital is also spent in year 5, totaling \$600. The plant starts up in year 6 with revenue of \$2,185 per year and manufacturing costs of \$1,100 per year. Depreciation could be done by a.) straight line depreciation over the class life of 16 years for a petroleum refinery or b.) the 10-years MACRS depreciation schedule. Analyze both options over the project life of 21 years. Assume salvage of \$500 in year 21 is recoverable, in addition to land and working capital. Use an internal hurdle rate of 12% and a tax rate of 30%.

(14pts) Calculate all of the non-discounted and discounted profitability metrics.

(4pts) Discuss the profitability of this project and give a recommendation to management about the feasibility of proceeding.

(2pts) Discuss how these estimates might vary compared to actual prices over the life of the project.

(3pts) Between depreciation options a and b, how do the ROI and IRR metrics compare? Why?

2. Compare the cost of owning an electric vehicle vs. gasoline vehicle using **all applicable economic metrics**, and the following assumptions:  
The gasoline vehicle is a 2020 Honda Civic, priced at \$21,000. You drive 6,500 miles per year and gas in your area has an average cost of \$2.50 per gallon. The maintenance costs annually average \$368 for this vehicle. The electric vehicle is a 2020 Prius Prime (this is a hybrid, but assume you predominantly drive it in electric mode). The purchase price is \$27,600, with a \$4,500 federal tax credit. The car consumes 7kWhr of electricity on single charge, with a driving range of 28 miles per charge. The annual maintenance cost is slightly lower at \$203. Electricity in your area has an average cost of 17 cents per kWhr. Assume an interest rate of 4% and 10 years of ownership.

A) (6pts) Which option would you recommend?

Explain how the following variations would change your decision:

B) (3pts) An interest rate of 10%

C) (3pts) Lifetime of 15 years

D) (3pts) Expiration of the electric vehicle \$4,500 federal tax credit.

3. (10pts) Given two machines:

	A	B
Initial Cost	\$55,000	\$75,000
Total Annual Costs	\$16,200	\$12,450

With interest at 10% per year, at what service life do these two machines have the same equivalent uniform annual cost?