Biology 4605/7220 NAME________________________
23 September 2015 Quiz #3b

1.1. The Michaelis–Menten enzyme kinetics model (1913 *Biochem Z* 49: 333–369) is named after German biochemist Leonor Michaelis and Canadian physician Maud Menten. Yu and Rappaport (1997 *Environ Health Perspectives* 105 : 496–503) show that the Michaelis Menten model describes the clearance rate (*k*) of insoluble dust particles from lungs as a function of the maximum rate (*kmax)*, the particulate burden (*m*), and the particulate burden (*mhalf*) at which *k* is half of *kmax*.

$$k = \frac{k\,\max \cdot mhalf}{m + mhalf} \qquad\qquad k = k\,\max\left(\frac{mhalf}{m + mhalf}\right)$$

The parameter *mhalf* and the variable *m* have units of milligrams (mg), *k* has units of %/day

a. Show units for the ratio in parentheses ___________ and for *k*max ___________ [1+1]

b. Explain your answer for units of *k*max [2]

c. Does the ratio in parentheses increase or decrease as lung burden *m* decreases?

Write your answer here _________ [no mark]

d. Given *mhalf* = 0.97 mg for photocopier toner dust (PTT) and *k*max = 0.009/day for experimental rats, calculate the expected clearance rate at

m = 5 mg $E(k)$ = _______________[1]

m = 0.5 mg. $E(k)$ = _______________[1]

d. Show your calculations, with units, for 0.5 mg [2]

e. Does the expected clearance E(*k*) change in the direction you expected, with decrease in lung burden *m* ? [no mark]

2. Using the expected value $E(k)$ at a burden of *m* = 0.5 mg, complete a data equation for an observed value of *k* = 0.008

k	=	$E(k)$	+	residual
_____	=	__________	+	____________

[3]