

# Assignment #3 - Answers

①



a)  $c = \frac{8.0}{2.00} = 4.0 \text{ mol/L}$        $r = \frac{4.0}{3.2} = 1.25 \text{ mol/(L}\cdot\text{s)}$   $\text{CH}_4$

b)  $r = 1.25 \times 2 = 2.5 \text{ mol/(L}\cdot\text{s)}$   $\text{O}_2$

c)  $1.25 \text{ mol/(L}\cdot\text{s)}$   $\text{CO}_2$

d)  $2.5 \text{ mol/(L}\cdot\text{s)}$   $\text{H}_2\text{O}$

2) #3 → The rxn will increase in rate by a factor of 5-8x b/c an increase of  $10^\circ\text{C}$  doubles or triples the rate (pg. 368)  
#4 → With coal dust, there is an increase in surface area. Therefore the rxn rate will increase.

3) #2 → a)  $[\text{A}] = 1$        $r = k [\text{A}]^1$        $r = 0.003 [\text{A}]^1$   
 $[\text{B}] = 0$        $3 \times 10^{-4} = k (0.10)^1$        $k = 0.003$

#1 → a) concentration, temperature, surface area

b) nature of molecules, temperature, catalyst

4) [A] = 1 [B] = 0 [C] = 2

r = k [A]^1 [C]^2

5) [P] = 0 [Q] = 2 [R] = 1

r = k [Q]^2 [R]^1

2 x 10^-3 = k [0.04]^2 [0.10] k = 12.5 L^2 / (mol^2 \* s)

r = 12.5 [Q]^2 [R]^1

b) 4 x 10^3 = k (0.02)^2 (0.06)^1/2 k = 4.08 x 10^7

a) r = (4.08 x 10^7) (0.10)^2 (0.06)^1/2 = 9.99 x 10^4 mol / (L \* s)

b) r = (4.08 x 10^7) (0.02)^2 (0.06)^1/2 = 4.0 x 10^3 mol / (L \* s)

c) r = (4.08 x 10^7) (0.02)^2 (0.90)^1/2 = 1.5 x 10^4 mol / (L \* s)

7) a) [A]\_t = (0.004) e^-(2.2 x 10^-5)(3600)

1 hour = 3600 s

= 3.7 x 10^-3 M

b) [A]\_t = (0.004) e^-(2.2 x 10^-5)(86400)

1 day = 86400 s

= 6.0 x 10^-4 M

8) a) ln [A]\_0 / [A]\_t = kt ln (25) / (15) = k(120)

2 hours = 120 min

k = 4.26 x 10^-3 min^-1

b) 5.0 = [A]\_0 e^-(4.26 x 10^-3)(180)

3 hours = 180 min

[A]\_0 = 10.8 mg/kg

9)

$$k t_{1/2} = 0.693$$

$$k(28) = 0.693 \quad k = 0.025 \text{ y}^{-1}$$

$$\ln \frac{(100)}{(2)} = 0.025 t \quad t = 156 \text{ years}$$

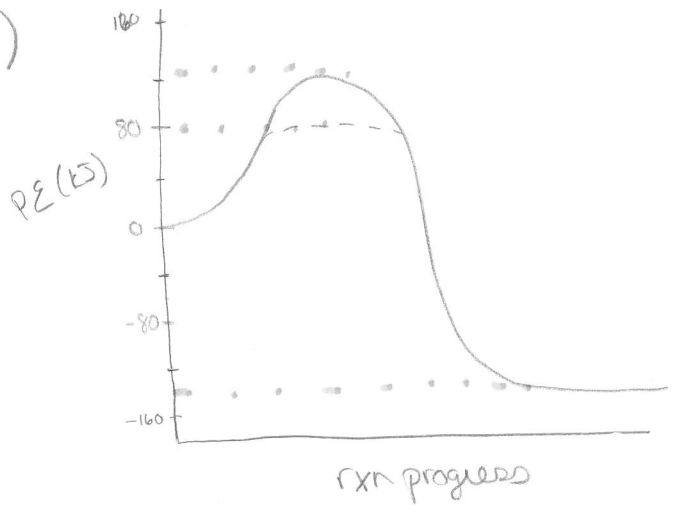
10) a) exothermic

b) -40 kJ, -40 kJ

c) +60 kJ, +40 kJ

d) Catalysts speed up a rxn by decreasing the energy required for the rxn to occur.

11)



12) 28 min = 0.47 h

$$\ln \left( \frac{50}{1} \right) = 1.47 t$$

$$k(0.47) = 0.693$$

$$k = 1.47$$

$$t = 2.66 \text{ h}$$

13) a) i)  $(2.41 \times 10^{-6}) t_{1/2} = 0.693 \quad t_{1/2} = 287552 \text{ s} = 4792 \text{ min} = 79.9 \text{ h}$

ii)  $(2.22 \times 10^{-4}) t_{1/2} = 0.693 \quad t_{1/2} = 3122 \text{ s} = 52 \text{ min} = 0.87 \text{ h}$

$$b) [A]_t = (0.10) e^{-(2.41 \times 10^{-6})(29988)} = 0.093 \text{ M}$$

$$8.33 \text{ h} = 29988 \text{ s}$$