These problems are intended to ***supplement*** the problems in the textbook, not ***replace*** them.

Questions

Consider this reaction: $CH_3CHO\,(g) \rightarrow CH_4\,(g) + CO\,(g)$

The following data were collected at a particular temperature:

time (s)	0	1,200	2,000	6,000	10,000	15,000	20,000
$[CH_3CHO]$ (M)	0.0500	0.0300	0.0240	0.0120	0.0080	0.0056	0.0043

1. Graphically determine whether this reaction is zero, first or second order.
2. Write the rate law, including a value for the rate constant (with its correct units).
3. What is the initial half-life for this reaction?
4. How long will it take the concentration of acetaldehyde, CH_3CHO, to be equal to 1.00% of its original value?
5. What is the concentration of acetaldehyde after 10.0 hours?

Consider this reaction: $2\,NO_2Cl\,(g) \rightarrow 2\,NO_2\,(g) + Cl_2\,(g)$

The following data were collected at a particular temperature:

time (min)	0	5.00	10.0	15.0	20.0	30.0
$[NO_2Cl]$ (M)	5.000	4.375	3.750	3.125	2.500	1.250

6. Graphically determine whether this reaction is zero, first or second order.
7. Write the rate law, including a value for the rate constant (with its correct units).
8. What is the initial half-life for this reaction?
9. How long will it take the concentration of NO_2Cl to reach 0.100 M?
10. What is the concentration of NO_2Cl after 12.5 minutes?

Consider this reaction: $2\,A \rightarrow B + 3\,C$

The following data were collected at a particular temperature:

time (s)	0	30.0	60.0	90.0	120.0	240.0	360.0
[A] (M)	0.0500	0.0380	0.0310	0.0260	0.0230	0.0150	0.0110

11. Graphically determine whether this reaction is zero, first or second order.
12. Write the rate law, including a value for the rate constant (with its correct units).
13. What is the initial half-life for this reaction?
14. What is the concentration of A after 1.00 hour?
15. How many minutes will it take [A] to decrease from 0.0400 M to 0.0200 M?

Consider this reaction: $SO_2Cl_2\,(g) \rightarrow SO_2\,(g) + Cl_2\,(g)$

The following data were collected at a particular temperature:

time (min)	0	100	200	300	400	500
$[SO_2Cl_2]$ (M)	0.1000	0.0876	0.0768	0.0673	0.0590	0.0517

time (min)	600	700	800	900	1000	1100
$[SO_2Cl_2]$ (M)	0.0453	0.0397	0.0348	0.0305	0.0267	0.0234

16. Graphically determine whether this reaction is zero, first or second order.
17. Write the rate law, including a value for the rate constant (with its correct units).
18. What is the initial half-life for this reaction?
19. How long will it take $[SO_2Cl_2]$ to reach 0.0100 M?
20. What is the concentration of SO_2Cl_2 after 1.00 hour?

Answer the following questions.

21. For a reaction that is zero-order with respect to reactant A, what will be the concentration of A after 26 minutes if the initial concentration of A is 0.54 M and the rate constant is 3.8×10^{-3} M/min?

22. The half-life for a first-order reaction is 276 minutes. What is the rate constant?

23. If 1.23 mg of a 5.00 mg sample of arsenic-78 remains after 182 minutes, what is the half-life of arsenic-78? The decay process is first-order.

24. A first-order reaction has a half-life of 4.48 months. How long will it take for the concentration to decrease to 25% of its original value?

25. The decomposition of a pesticide in water is second-order, with a half-life of 3.50 years. The initial concentration is 6.75 mg/mL. How long will it take for the concentration to decrease to 1.50 mg/mL?

<u>Answers</u>

If you cannot figure out how to get the correct answer, go to your instructor, Science Tutoring Center, etc.

Note: Answers obtained graphically should be similar to those listed here, but may not be exactly equal.

1. second
2. rate = 0.011 $M^{-1}\cdot s^{-1}$ $[CH_3CHO]^2$
3. 1.8×10^3 s (30 min)
4. 1.8×10^5 s (50 hr)
5. 0.0024 M
6. zero
7. rate = 0.125 M/min
8. 20.0 min
9. 39.2 min
10. 3.44 M
11. second
12. rate = 0.195 $M^{-1}\cdot s^{-1}$ $[A]^2$
13. 103 s
14. 1.39×10^{-3} M
15. 2.14 min
16. first
17. rate = 0.00132 min^{-1} $[SO_2Cl_2]$
18. 525 min
19. 1.74×10^3 min (29.1 hr)
20. 0.09239 M
21. 0.44 M
22. 0.00251 min^{-1}
23. 90.0 min
24. 8.97 months
25. 12.3 years