1. What is the reaction rate in terms of ΔA?

$$2A + 3B \rightarrow 4C + 5D$$

a) $\frac{-\Delta A}{\Delta t}$

b) $\frac{-\Delta A}{2\Delta t}$

c) $\frac{\Delta A}{\Delta t}$

d) $\frac{-2\Delta A}{\Delta t}$

$$aA + bB \rightarrow cC + dD$$

$$\text{Rate} = -\frac{1}{a}\frac{\Delta A}{\Delta t}$$

$$\text{Rate} = -\frac{1}{2}\frac{\Delta A}{\Delta t}$$

$$\text{Rate} = -\frac{\Delta A}{2\Delta t}$$

② What is the reaction rate in terms of ΔC?

$$2A + 3B \longrightarrow 4C + 5D$$

a) $+\dfrac{\Delta C}{\Delta t}$

b) $+\dfrac{4\Delta C}{\Delta t}$

c) $+\dfrac{\Delta C}{4\Delta t}$

d) $-\dfrac{4\Delta C}{\Delta t}$

$$\text{Rate} = +\frac{1}{4}\frac{\Delta C}{\Delta t}$$

$$\text{Rate} = +\frac{\Delta C}{4\Delta t}$$

③ For the following reaction,

(a) express the rate in terms of changes in $[H_2]$, $[O_2]$, and $[H_2O]$ with respect to time, and

(b) find the rate at which $[H_2O]$ is increasing when $[O_2]$ is decreasing at 0.23 mol/L·s.

$$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$$

(a) $\text{Rate} = -\dfrac{\Delta[H_2]}{2\Delta t} = -\dfrac{\Delta[O_2]}{\Delta t} = \dfrac{+\Delta[H_2O]}{2\Delta t}$

(b) $\dfrac{+\Delta[H_2O]}{2\Delta t} = \dfrac{-\Delta[O_2]}{\Delta t} = -\left(-0.23\ \dfrac{mol}{L\cdot s}\right)$

$$\frac{\Delta[H_2O]}{\Delta t} = 2\left(0.23\ \frac{mol}{L\cdot s}\right) = 0.46\ \frac{mol}{L\cdot s}$$

④ In the combustion of methane, which reactant has the greatest rate of disappearance?

products

$$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$$

a) CH_4

b) O_2

~~c)~~ CO_2

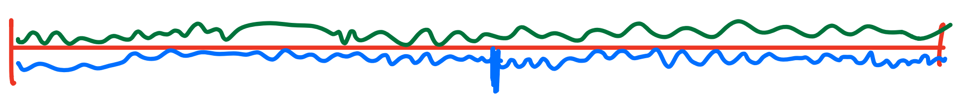
~~d)~~ H_2O

e) CH_4 and O_2 have the same rate of disappearance

$$-\frac{\Delta[CH_4]}{\Delta t} = -\frac{1}{2}\frac{\Delta[O_2]}{\Delta t}$$

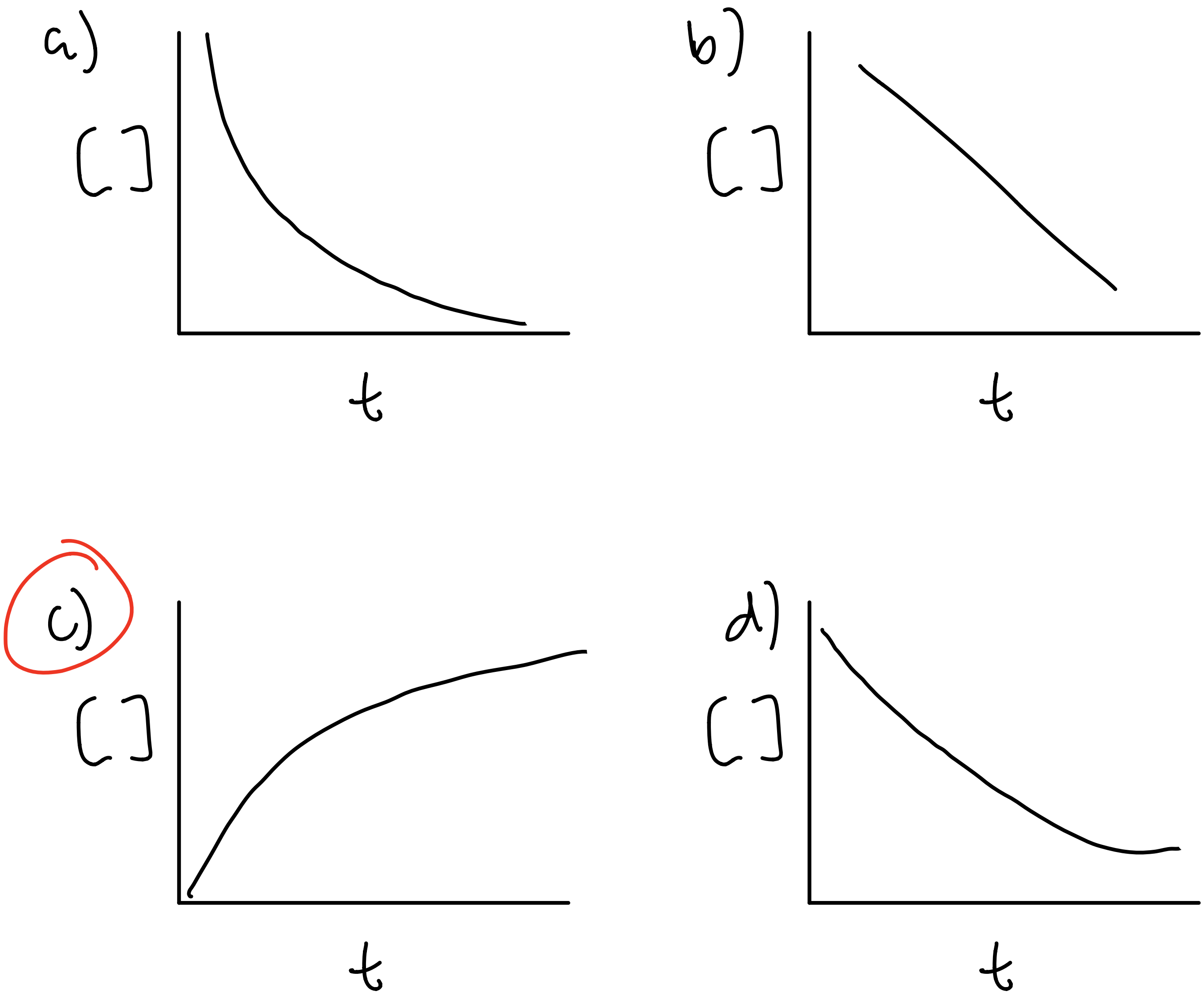
$$2 \cdot \frac{\Delta[CH_4]}{\Delta t} = \frac{\Delta[O_2]}{\Delta t}$$

start finish



reactants products

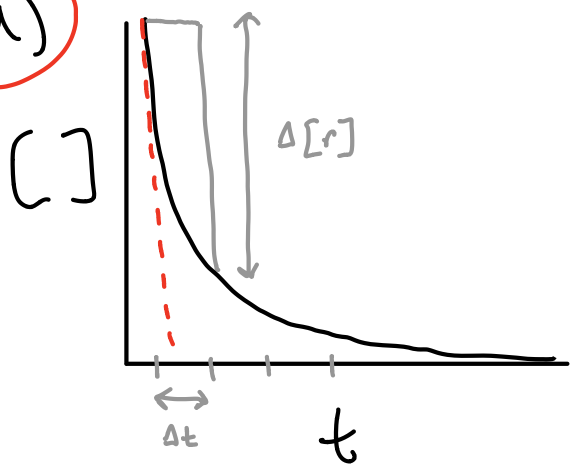
⑤ Assuming the reaction proceeds forward, which of the following graphs is not a possible graph of concentration vs. time for a reactant?



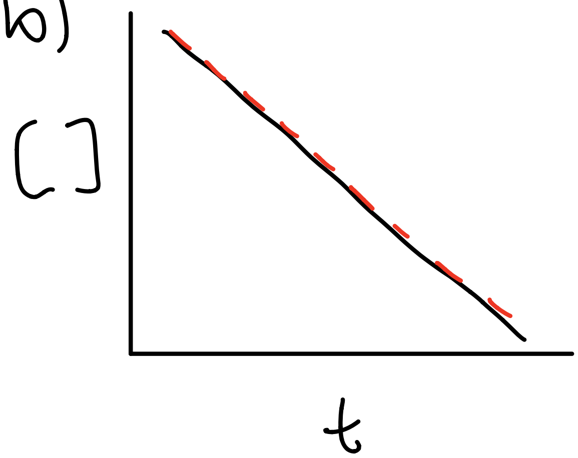
$aA + bB \rightarrow cC + dD$

(6) Assuming that each graph has the same concentration and time axes, which graph has the greatest initial rate of disappearance of reactant?

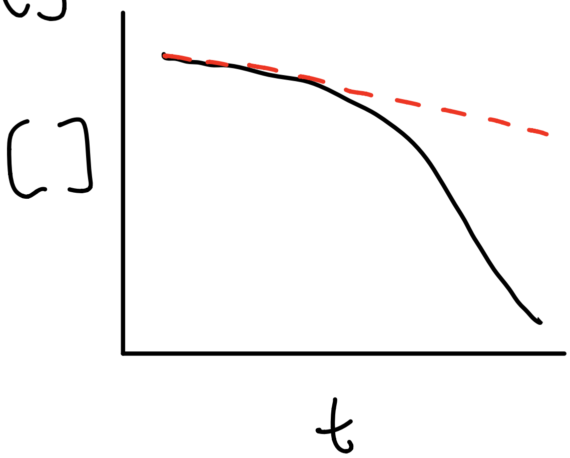
a)



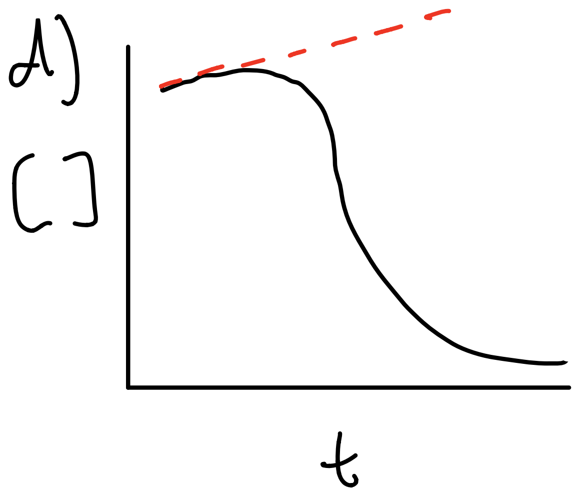
b)



c)

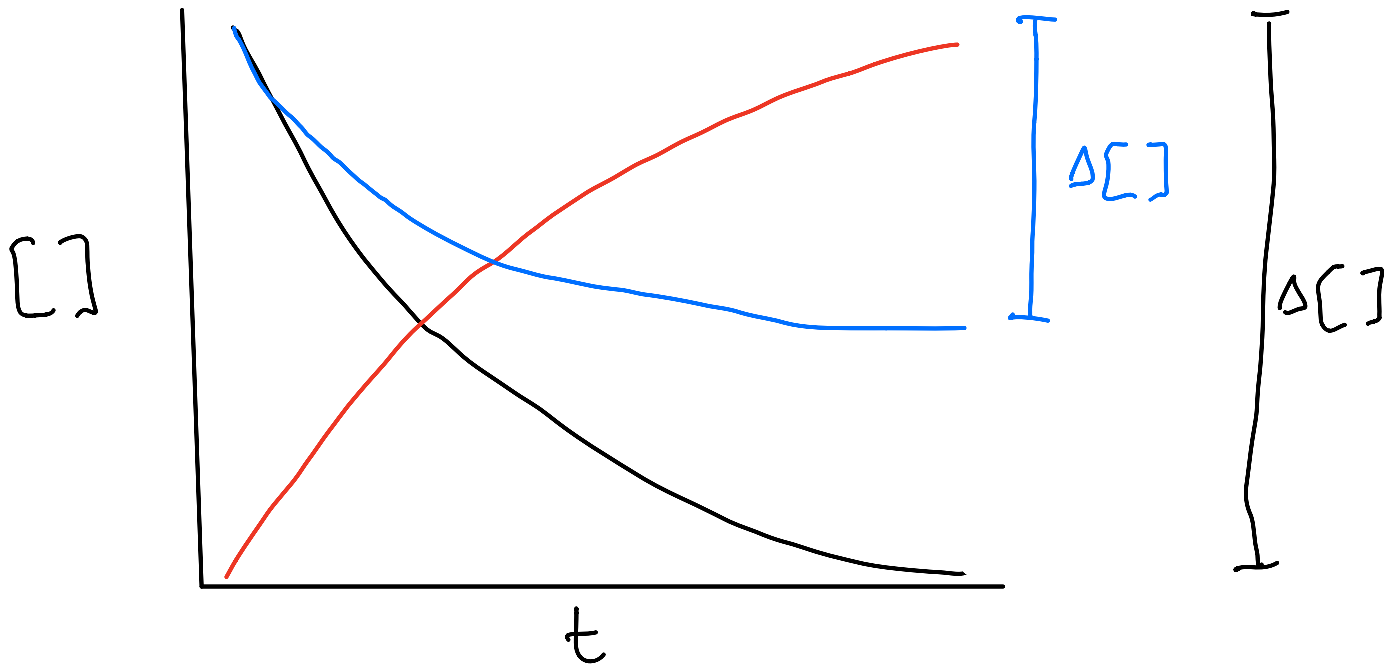


d)



⑦ For the below reaction, which curve represents hydrogen?

$$O_{2(g)} + 2H_{2(g)} \rightarrow 2H_2O_{(g)}$$



~~a)~~ Red

b) Black

c) Blue

d) Either black or blue

~~e)~~ Any of these could be hydrogen

Rate Law

- $Rate = k[A]^m[B]^n$
  - → k = constant (specific to rxn)
  - → m and n = exponents determined by the order of the reaction
  - → A and B = reactants

    $aA \rightarrow bB$

- Zero order
  - → rate doesn't change as $[A]$ doubles

    $Rate = k[A]^0 = k(1) = k$

    $Rate = k$

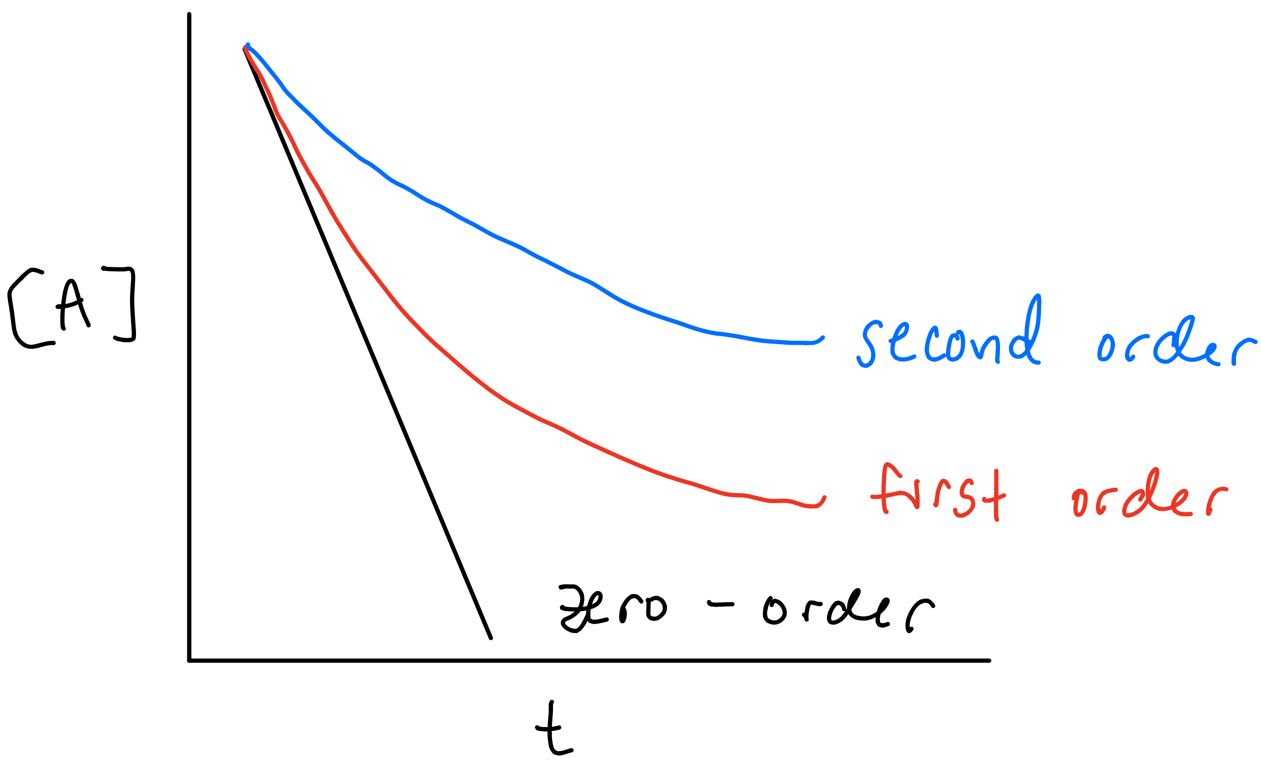
- First order
  - → rate doubles as [A] doubles

    $$Rate = k[A]^1$$

    $$Rate = k[A]$$

- Second order
  - → rate quadruples as [A] doubles

    $$Rate = k[A]^2$$



8 Use the following reaction and data to determine the individual and overall reaction orders

$$NO_2 + CO \longrightarrow NO + CO_2$$

$$\text{rate} = k[NO_2]^m[CO]^n$$

Experiment	Initial rate (mol/L·s)	Initial $[NO_2]$ (mol/L)	Initial $[CO]$ (mol/L)
1	0.0050	0.10	0.10
2	0.080	0.40	0.10
3	0.0050	0.10	0.20

$$\frac{\text{Rate } 2}{\text{Rate } 1} = \frac{k[NO_2]_2^m \cancel{[CO]_2^n}}{k[NO_2]_1^m \cancel{[CO]_1^n}}$$

$$\frac{\text{Rate } 2}{\text{Rate } 1} = \frac{\cancel{k}[NO_2]_2^m}{\cancel{k}[NO_2]_1^m}$$

$$\frac{0.08}{0.005} = \left(\frac{0.4}{0.1}\right)^m$$

$$16 = (4)^m \quad \therefore \quad m = 2$$

$$\frac{\text{Rate } 3}{\text{Rate } 1} = \frac{\cancel{k}[CO]_3^n}{\cancel{k}[CO]_1^n}$$

$$\frac{.0050}{.0050} = \left(\frac{.2}{.1}\right)^n$$

$$1 = (2)^n \quad \therefore \quad n = 0$$

order = 2