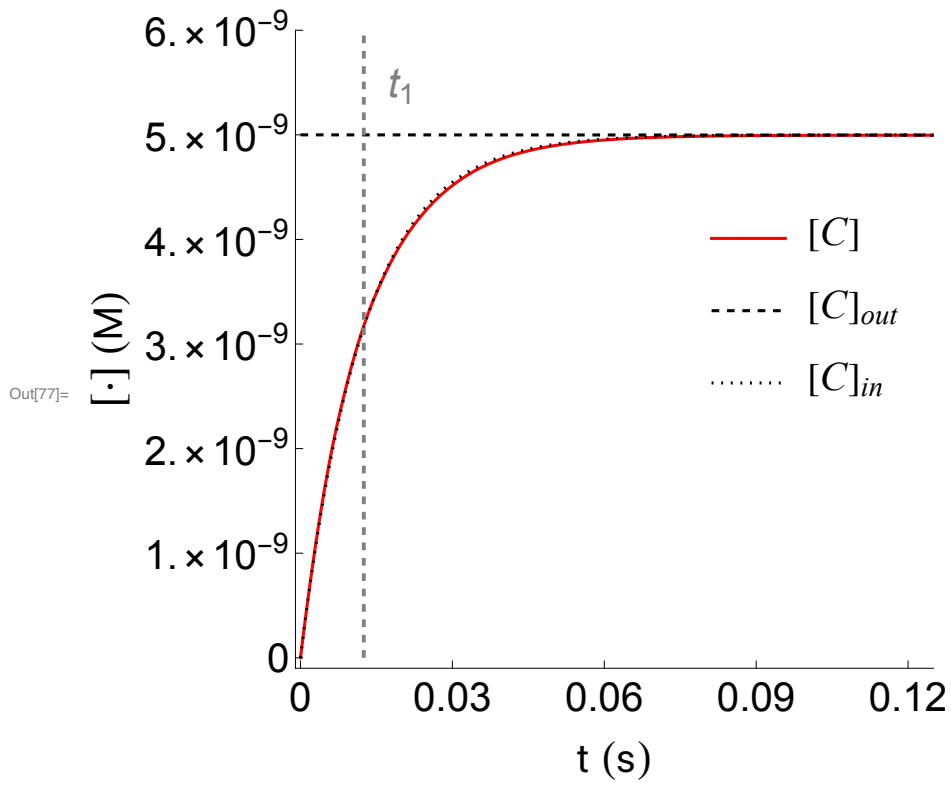


```

In[60]:= k1 = 4 * 10^6; k2 = 15; k0 = 25; (*=k_{-1}*)
Km = (k0 + k2) / k1;
s0 = Km; e0 = 10^(-3) * s0; (*e0<<s0+Km*)
c0 = 0; p0 = 0;
tend = 320;
A1 = s0 + c0 + p0; A2 = e0 + c0;
t1 = 1 / (k1 * (Km + A1));
t2 = 1 / (k1 * A2);
vm = k2 * e0;
10 * t2 / 15;
s = .; e = .; c = .; p = .;
tend = 10 * t1;
Sol1 = NDSolve[{D[s[t], t] == -k1 * e[t] * s[t] + k0 * c[t],
  D[e[t], t] == -k1 * e[t] * s[t] + (k0 + k2) * c[t],
  D[c[t], t] == k1 * e[t] * s[t] - (k0 + k2) * c[t], D[p[t], t] == k2 * c[t],
  s[0] == s0, e[0] == e0, c[0] == c0, p[0] == p0}, {s, e, c, p}, {t, 0, tend}];
Plot31 = Plot[Evaluate[c[t] /. First[Sol1]],
  {t, 0, tend}, PlotPoints -> 4000, Mesh -> False, AxesLabel -> {t, c},
  PlotRange -> {{0, tend}, {0, 10^(-8)}}, PlotStyle -> Red,
  FrameLabel -> {Style["t (s)", FontFamily -> "MS Serif", FontSize -> 21],
  Style["[.] (M)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];
plt2 = RegionPlot[0.115 < x < tend, {x, tend / 2, tend},
  {y, 0, 10^(-8)}, PlotStyle -> Directive[Gray, Opacity[.9]]];
Pcex = Plot[(A2 * ProductLog[(s0 / Km) * Exp[(-vm * t + s0) / Km]]) /
  (1 + ProductLog[(s0 / Km) * Exp[(-vm * t + s0) / Km]]),
  {t, 0, tend}, PlotPoints -> 4000, Mesh -> False, AxesLabel -> {t, ce},
  PlotRange -> All, PlotStyle -> {Black, Dashed},
  FrameLabel -> {Style["t (s)", FontFamily -> "MS Serif", FontSize -> 21],
  Style["[.] (M)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];
Pcin = Plot[(A2 * s0) / (Km + s0) + (c0 - (A2 * s0) / (Km + s0)) * Exp[-k1 * (Km + s0) * t],
  {t, 0, tend}, PlotPoints -> 4000, Mesh -> False, AxesLabel -> {t, ci},
  PlotRange -> {{0, tend}, {0, 10^(-8)}}, PlotStyle -> {Black, Dotted},
  FrameLabel -> {Style["t (s)", FontFamily -> "MS Serif", FontSize -> 21],
  Style["[.] (M)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];
Show[Plot31, Pcex, Pcin,
  ParametricPlot[{t1, u}, {u, 0, 6 * 10^(-9)}, PlotStyle -> {Gray, Dashed, Thick}],
  PlotRange -> {{-0.001, tend}, {-0.00000000001, 6 * 10^(-9)}},
  Epilog -> {Inset[Column[{LineLegend[{Red, {Black, Dashed}, {Black, Dotted}],
  {"[C]", "[C]_out", "[C]_in"}}, LabelStyle -> {FontFamily -> "Times New Roman",
  FontSize -> 21, FontSlant -> Italic}]}], Scaled[{0.8, 0.56}]],
  Inset[Graphics[{Gray, Text[Style["t1", 21]}], {0.02, 5.5 * 10^(-9)}]},
  MaxRecursion -> 0, PlotPoints -> {200, 100},
  AspectRatio -> 1,
  AxesOrigin -> {0, 0},

```

```
RotateLabel → True,  
LabelStyle → {21, GrayLevel[0]},  
FrameTicks → {{{0, 0.000000001, 0.000000002, 0.000000003, 0.000000004,  
0.000000005, 0.000000006, 0.000000008, 0.00000001}, None},  
{0, 0.03, 0.06, 0.09, 0.12}, None}}, LabelStyle → {21, GrayLevel[0]},  
ImageSize → {450, 450}, AspectRatio → Full, PlotLabel → None]
```



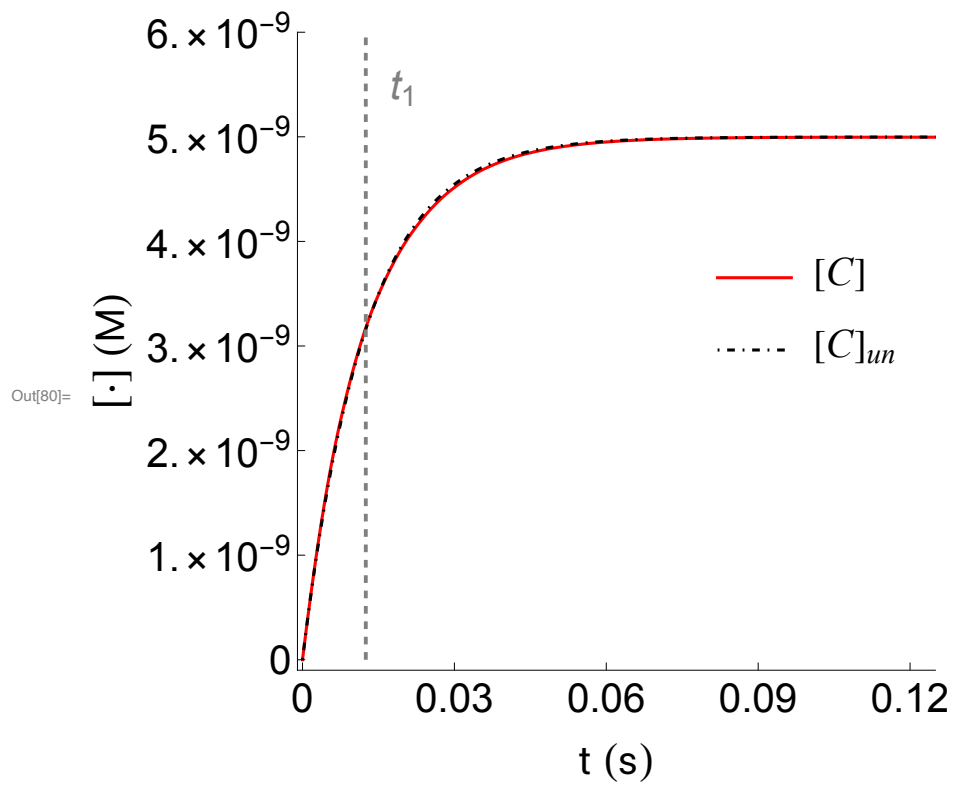
In[79]:=

```

Pcu = Plot[(A2 * ProductLog[(s0 / Km) * Exp[(1 / Km) * (s0 - k2 * A2 * t)])] /
  (1 + ProductLog[(s0 / Km) * Exp[(1 / Km) * (s0 - k2 * A2 * t)]]) +
  (c0 - (A2 * s0) / (Km + s0)) * Exp[-k1 * (Km + s0) * t], {t, 0, tend},
  PlotPoints -> 4000, Mesh -> False, AxesLabel -> {t, cu},
  PlotRange -> All, PlotStyle -> {Black, DotDashed},
  FrameLabel -> {Style["t (s)", FontFamily -> "MS Serif", FontSize -> 21],
  Style["[.] (M)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];

Show[Plot31, Pcu,
  ParametricPlot[{t1, u}, {u, 0, 6 * 10^(-9)}, PlotStyle -> {Gray, Dashed, Thick}],
  PlotRange -> {{-0.001, tend}, {-0.0000000001, 6 * 10^(-9)}},
  Epilog -> {Inset[Column[{LineLegend[{Red, {Black, DotDashed}},
  {"[C]", "[C]un"}, LabelStyle -> {FontFamily -> "Times New Roman",
  FontSize -> 21, FontSlant -> Italic}]}], Scaled[{0.8, 0.56}]],
  Inset[Graphics[{Gray, Text[Style["t1", 21]}], {0.02, 5.5 * 10^(-9)}]},
  MaxRecursion -> 0, PlotPoints -> {200, 100},
  AspectRatio -> 1,
  AxesOrigin -> {0, 0},
  RotateLabel -> True,
  LabelStyle -> {21, GrayLevel[0]},
  FrameTicks -> {{{0, 0.000000001, 0.000000002, 0.000000003, 0.000000004,
  0.000000005, 0.000000006, 0.000000008, 0.00000001}, None},
  {{0, 0.03, 0.06, 0.09, 0.12}, None}}, LabelStyle -> {21, GrayLevel[0]},
  ImageSize -> {450, 450}, AspectRatio -> Full, PlotLabel -> None]
(*****)

```

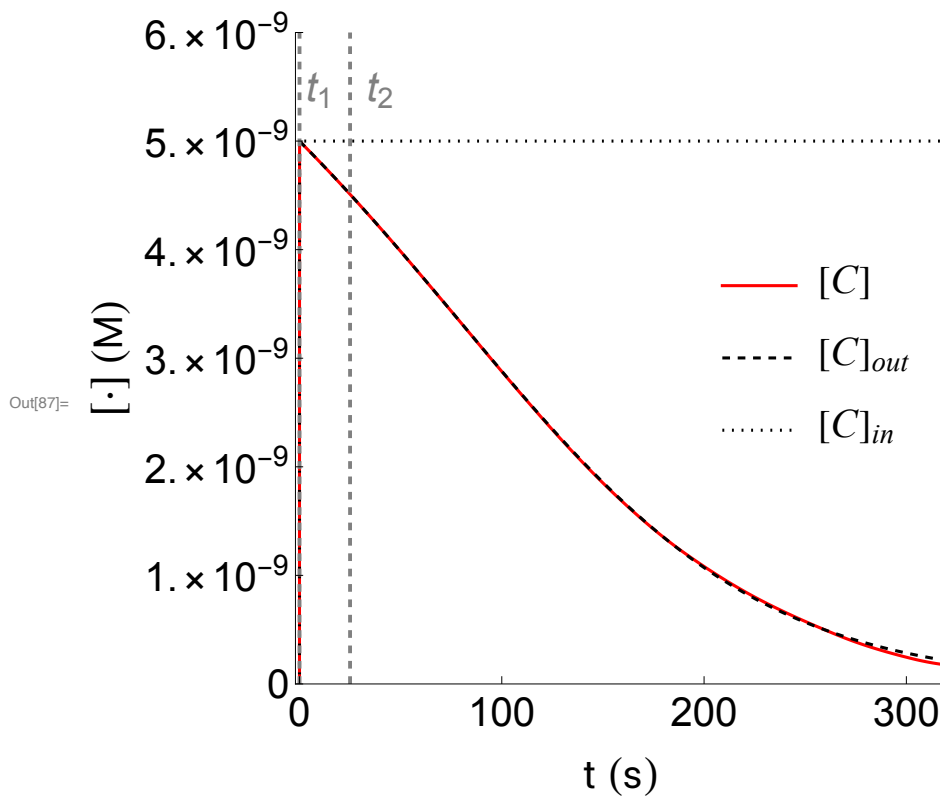


In[81]= `tend = 100 * t2;`

```

In[82]:= Sol2 = NDSolve[{D[s[t], t] == -k1 * e[t] * s[t] + k0 * c[t],
  D[e[t], t] == -k1 * e[t] * s[t] + (k0 + k2) * c[t],
  D[c[t], t] == k1 * e[t] * s[t] - (k0 + k2) * c[t], D[p[t], t] == k2 * c[t],
  s[0] == s0, e[0] == e0, c[0] == c0, p[0] == p0}, {s, e, c, p}, {t, 0, tend}];
Plot33 = Plot[Evaluate[c[t] /. First[Sol2]],
  {t, 0, tend}, PlotPoints → 4000, Mesh → False, AxesLabel → {t, c},
  PlotRange → {{0, tend}, {0, 10-8}}, PlotStyle → Red,
  FrameLabel → {Style["t (s)", FontFamily → "MS Serif", FontSize → 21],
  Style["[.] (M)", FontFamily → "MS Serif", FontSize → 21]},
  RotateLabel → True, Frame → {{Automatic, False}, {Automatic, False}}];
plt42 = RegionPlot[0 < x < 10 * t2 / 15, {x, 0, tend / 15},
  {y, 0, 10-8}, PlotStyle → Directive[Gray, Opacity[.9]]];
(**)
Pcex = Plot[(A2 * ProductLog[(s0 / Km) * Exp[(-vm * t + s0) / Km]]) /
  (1 + ProductLog[(s0 / Km) * Exp[(-vm * t + s0) / Km]]),
  {t, 0, tend}, PlotPoints → 4000, Mesh → False, AxesLabel → {t, ce},
  PlotRange → All, PlotStyle → {Black, Dashed},
  FrameLabel → {Style["t (s)", FontFamily → "MS Serif", FontSize → 21],
  Style["[.] (M)", FontFamily → "MS Serif", FontSize → 21]},
  RotateLabel → True, Frame → {{Automatic, False}, {Automatic, False}}];
Pcin = Plot[(A2 * s0) / (Km + s0) + (c0 - (A2 * s0) / (Km + s0)) * Exp[-k1 * (Km + s0) * t],
  {t, 0, tend}, PlotPoints → 4000, Mesh → False, AxesLabel → {t, ci},
  PlotRange → {{0, tend}, {0, 10-8}}, PlotStyle → {Black, Dotted},
  FrameLabel → {Style["t (s)", FontFamily → "MS Serif", FontSize → 21],
  Style["[.] (M)", FontFamily → "MS Serif", FontSize → 21]},
  RotateLabel → True, Frame → {{Automatic, False}, {Automatic, False}}];
Show[Plot33, Pcex, Pcin,
  ParametricPlot[{t1, u}, {u, 0, 6 * 10-9}, PlotStyle → {Gray, Dashed, Thick}],
  ParametricPlot[{t2, u}, {u, 0, 6 * 10-9}, PlotStyle → {Gray, Dashed, Thick}],
  PlotRange → {{-2, 320}, {0, 6 * 10-9}},
  Epilog → {Inset[Column[{LineLegend[{Red, {Black, Dashed}, {Black, Dotted}},
  {"[C]", "[C]out", "[C]in"}, LabelStyle → {FontFamily → "Times New Roman",
  FontSize → 21, FontSlant → Italic}]}], Scaled[{0.8, 0.5}]],
  Inset[Graphics[{Gray, Text[Style["t2", 21]}], {40, 5.5 * 10-9}],
  Inset[Graphics[{Gray, Text[Style["t1", 21]}], {10, 5.5 * 10-9}]},
  MaxRecursion → 0, PlotPoints → {200, 100}, AspectRatio → 1,
  AxesOrigin → {0, 0}, RotateLabel → True,
  LabelStyle → {21, GrayLevel[0]},
  FrameTicks → {{{0, 0.000000001, 0.000000002, 0.000000003, 0.000000004,
  0.000000005, 0.000000006, 0.000000008, 0.00000001}, None},
  {{0, 100, 200, 300, 400}, None}}, LabelStyle → {21, GrayLevel[0]},
  ImageSize → {450, 450}, AspectRatio → Full, PlotLabel → None]

```



```
In[88]:= Pcu = Plot[(A2 * ProductLog[(s0 / Km) * Exp[(1 / Km) * (s0 - k2 * A2 * t)])] /
  (1 + ProductLog[(s0 / Km) * Exp[(1 / Km) * (s0 - k2 * A2 * t)]]) +
  (c0 - (A2 * s0) / (Km + s0)) * Exp[-k1 * (Km + s0) * t], {t, 0, tend},
  PlotPoints -> 4000, Mesh -> False, AxesLabel -> {t, cu},
  PlotRange -> All, PlotStyle -> {Black, DotDashed},
  FrameLabel -> {Style["t (s)", FontFamily -> "MS Serif", FontSize -> 21],
    Style["[.] (M)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];
```

```

In[89]:= Show[Plot33, Pcu,
  ParametricPlot[{t1, u}, {u, 0, 6 * 10^(-9)}, PlotStyle -> {Gray, Dashed, Thick}],
  ParametricPlot[{t2, u}, {u, 0, 6 * 10^(-9)}, PlotStyle -> {Gray, Dashed, Thick}],
  PlotRange -> {{-2, 320}, {0, 6 * 10^(-9)}},
  Epilog -> {Inset[Column[{LineLegend[{Red, {Black, DotDashed}}],
    {"[C]", "[C]un"}, LabelStyle -> {FontFamily -> "Times New Roman",
    FontSize -> 21, FontSlant -> Italic}}], Scaled[{0.8, 0.5}]],
    Inset[Graphics[{Gray, Text[Style["t2", 21]]}], {40, 5.5 * 10^(-9)}],
    Inset[Graphics[{Gray, Text[Style["t1", 21]]}], {10, 5.5 * 10^(-9)}]},
  MaxRecursion -> 0, PlotPoints -> {200, 100}, AspectRatio -> 1,
  AxesOrigin -> {0, 0}, RotateLabel -> True,
  LabelStyle -> {21, GrayLevel[0]},
  FrameTicks -> {{0, 0.000000001, 0.000000002, 0.000000003, 0.000000004,
    0.000000005, 0.000000006, 0.000000008, 0.00000001}, None},
    {{0, 100, 200, 300, 400}, None}}, LabelStyle -> {21, GrayLevel[0]},
  ImageSize -> {450, 450}, AspectRatio -> Full, PlotLabel -> None]

```

