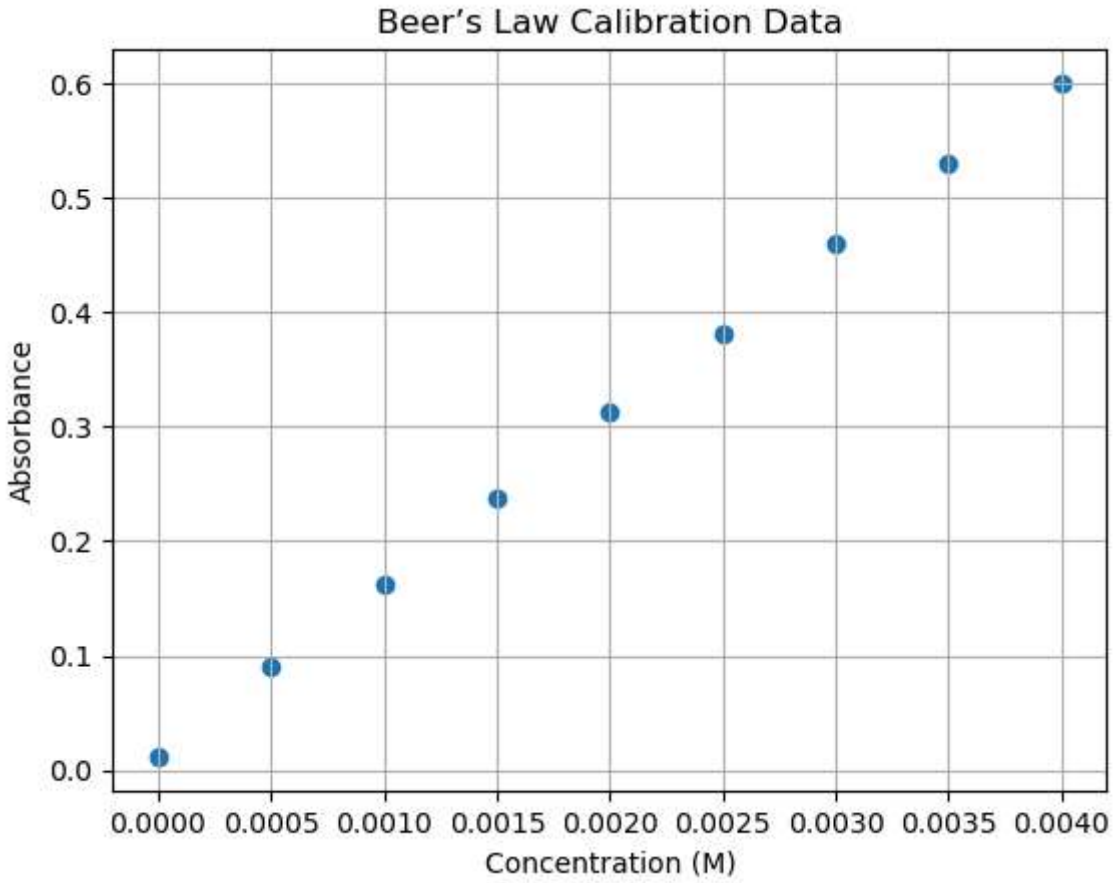
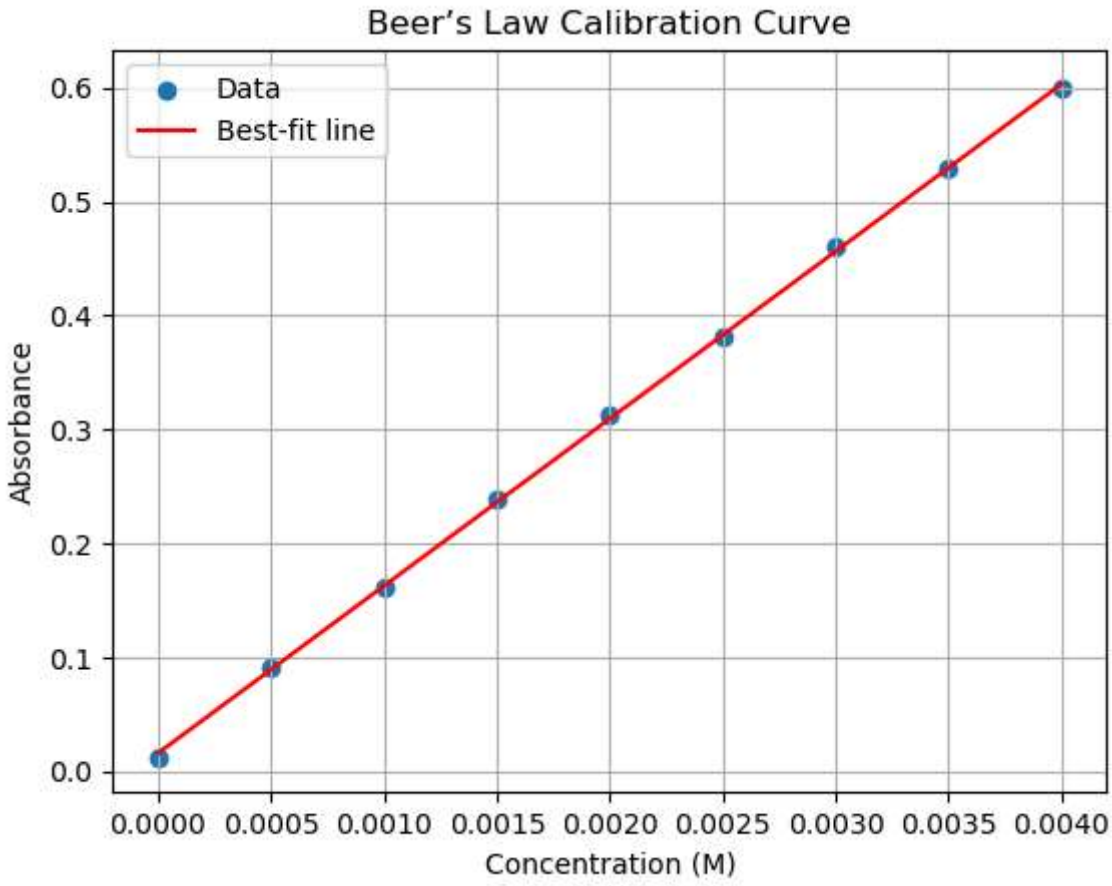
In [19]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

# ------------------------------
# 1. Create Beer's Law dataset
# ------------------------------
data = {
    "Concentration": [0.00000, 0.00050, 0.00100, 0.00150, 0.00200, 0.00250, 0.00300
    "Absorbance":    [0.012,   0.091,   0.162,   0.238,   0.313,   0.381,   0.460,
}

df = pd.DataFrame(data)

# ------------------------------
# 2. Plot raw calibration data
# ------------------------------
plt.scatter(df["Concentration"], df["Absorbance"])
plt.xlabel("Concentration (M)")
plt.ylabel("Absorbance")
plt.title("Beer's Law Calibration Data")
plt.grid(True)
plt.show()

# ------------------------------
# 3. Linear regression (A = mC + b)
# ------------------------------
x = df["Concentration"].values
y = df["Absorbance"].values

# Fit best-fit line
m, b = np.polyfit(x, y, 1)

print("Slope (m):", m)
print("Intercept (b):", b)

# Predicted absorbances
y_pred = m * x + b

# R-squared (goodness of fit)
ss_res = np.sum((y - y_pred)**2)
ss_tot = np.sum((y - np.mean(y))**2)
r_squared = 1 - (ss_res / ss_tot)

print("R^2:", r_squared)

# ------------------------------
# 4. Plot best-fit line
# ------------------------------
plt.scatter(x, y, label="Data")
plt.plot(x, y_pred, color="red", label="Best-fit line")
plt.xlabel("Concentration (M)")
plt.ylabel("Absorbance")
plt.title("Beer's Law Calibration Curve")
```

```
plt.grid(True)
plt.legend()
plt.show()
```




```
Slope (m): 146.8333333333333
Intercept (b): 0.01588888888888876
R^2: 0.9998089249646189
```



In [20]:
```
plt.savefig("beers_law_calibration_curve.png", dpi=300)
plt.show()
```

```
<Figure size 640x480 with 0 Axes>
```

In [ ]: