HW March 4, Johannes Byle

8.2 (a)

$$\mathcal{L} = T - U = \frac{1}{2}M\dot{R}^2 + \frac{1}{2}\mu\dot{r}^2 - U(r) - MgR$$

$$\mathcal{L} = \mathcal{L}_{cm} + \mathcal{L}_{rel}$$

(b)

$$\mathcal{L} = \frac{1}{2}M\dot{X}^2$$

$$\mathcal{L} = \frac{1}{2}M\dot{Y}^2 - MgY$$

$$\mathcal{L} = \frac{1}{2}M\dot{Z}^2$$

The center of mass moves the same as without the gravitational force, except it has a constant downward acceleration in one dimension.

$$\mathcal{L} = \frac{1}{2}\mu\dot{x}^2 - U(x)$$

$$\mathcal{L} = \frac{1}{2}\mu\dot{y}^2 - U(y)$$

$$\mathcal{L} = \frac{1}{2}\mu\dot{z}^2 - U(z)$$

Which is the same as

$$\mathcal{L} = \frac{1}{2}\mu\dot{r}^2 - U(r)$$