INSTRUCTIONS:

This quiz is open-book and open-note, and you may work with your classmates. Please answer all questions and show all of your work.
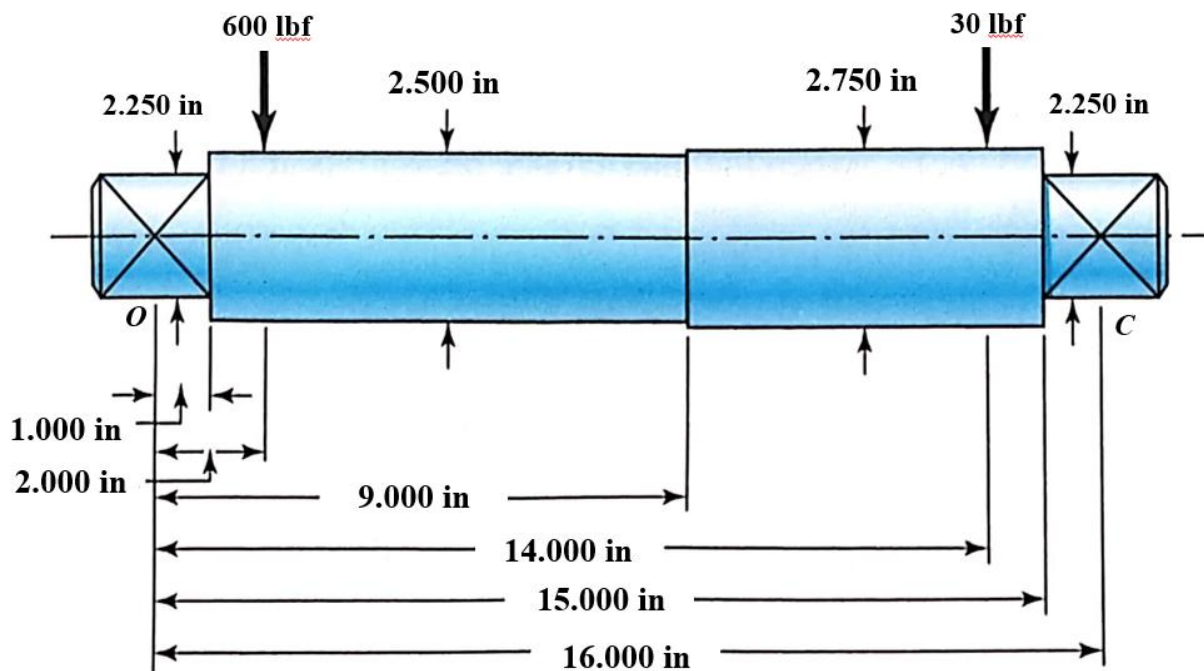
GIVEN:

The steel shaft shown is simply supported by journal bearings at O and C.

The lubricant is SAE 40 and the operating temperature is 65 °F.

The shaft rotates at 900 rpm.

The shaft diameter at O and C is 2.250 in and the bearing (bore) diameter is 2.255 in. The bearing is 2 in long.

Note that 1 reyn = 1 lbf·s/in² = 1 psi·s

FIND:
    (a) The radial load supported by bearing O.
    (b) The Sommerfeld number (S) for the bearing at O.
    (c) The minimum film thickness (h_0) in the bearing at O.

BONUS: Find the side flow (Q_s).

Minimum film thickness variable $\frac{h_0}{c}$ (dimensionless) vs. Bearing characteristic number, $S = \left(\frac{r}{c}\right)^2 \frac{\mu N}{P}$, with curves for $l/d = \infty$, 1, $1/2$, $1/4$. Eccentricity ratio ϵ (dimensionless) on the right axis.

Flow variable $\frac{Q}{rcNl}$ (dimensionless) vs. Bearing characteristic number, $S = \left(\frac{r}{c}\right)^2 \frac{\mu N}{P}$

Curves labeled: $l/d = 1/4$, $l/d = 1/2$, $l/d = 1$, $l/d = \infty$

Flow ratio $\frac{Q_s}{Q}$ vs. Bearing characteristic number, $S = \left(\frac{r}{c}\right)^2 \frac{\mu N}{P}$

Curves labeled: $l/d = 1/4$, $1/2$, 1, $l/d = \infty$