33.47 Lubricating oil at a temperature of $30°C$ has a specific gravity of 0.89 and a kinematic viscosity of $50cSt$. What is the absolute viscosity?

A. $0.00005 Pa \cdot s$

B. $0.003 Pa \cdot s$

C. $0.04 Pa \cdot s$

D. $0.1 Pa \cdot s$

Absolute Dynamic Viscosity is related to Kinematic Viscosity through the density.

$$\nu = \frac{\mu}{\rho}$$

$$\mu = \nu \rho$$

Apply the definition of Specific Gravity to determine the density of the oil. Look up the density of water at $30°C$ using the Properties of Water table, or use $1000\frac{kg}{m^3}$ as a typical value.

$$\rho_{water} = 995.7\frac{kg}{m^3}$$

$$SG = \frac{\rho}{\rho_{water}}$$

$$\rho = \rho_{water} SG = \left(995.7\frac{kg}{m^3}\right)(0.89) = 886.2\frac{kg}{m^3}$$

Solve for the absolute viscosity. Reference Measurement Relationships and convert units from cSt to $\frac{m^2}{s}$.

$$\mu = (50cSt)\left(886.2\frac{kg}{m^3}\right)\left(1 \times 10^{-6}\frac{m^2}{s \cdot cSt}\right) = 0.044\frac{kg}{m \cdot s}$$

Recall the definitions of N and Pa.

$$N = \frac{kg \cdot m}{s^2}$$

$$Pa = \frac{N}{m^2} = \frac{\frac{kg \cdot m}{s^2}}{m^2} = \frac{kg}{m \cdot s^2}$$

Multiply both sides by s.

$$Pa \cdot s = \frac{kg}{m \cdot s}$$

Therefore the units obtained are consistent with the units in the answer choices.

$$\mu = 0.044\frac{kg}{m \cdot s} = 0.044 Pa \cdot s$$

Answer C