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6. (10 points)

A diver descends from a salvage ship to the ocean floor at a depth of 35 m below the surface. The density of ocean water is $1.025 \times 10^3 \text{ kg/m}^3$.

(a) Calculate the gauge pressure on the diver on the ocean floor.

\[
P = \rho g h = (1.025 \times 10^3 \text{ kg/m}^3)(9.8)(35) = 351575 \text{ N/m}^2
\]

\[
6.5 \text{ ft} = 3.5 \times 10^5 \text{ Pa}
\]

(b) Calculate the absolute pressure on the diver on the ocean floor.

\[
P = P_a + \rho g h = 1 \times 10^5 \text{ N/m}^2 + 351575 \text{ N/m}^2
\]

\[
= 451575 \text{ Pa}
\]

\[
\therefore P = 4.5 \times 10^5 \text{ Pa}
\]
The diver finds a rectangular aluminum plate having dimensions $1.0 \text{ m} \times 2.0 \text{ m} \times 0.03 \text{ m}$. A hoisting cable is lowered from the ship and the diver connects it to the plate. The density of aluminum is $2.7 \times 10^3 \text{ kg/m}^3$. Ignore the effects of viscosity.

(c) Calculate the tension in the cable if it lifts the plate upward at a slow, constant velocity.

\[
\rho = \frac{m}{V} \quad m = \rho V \\
V = 0.06 \text{ m}^3 \\
\rho = 2.7 \times 10^3 \text{ kg/m}^3 \\
\rho = 162 \text{ kg}
\]

\[
F_T + F_{\text{buoy}} - F_g = ma \\
\text{at a constant velocity} \\
a = 0
\]

\[
\therefore F_T = F_g - F_{\text{buoy}} \\
= 162(9.8) - (1.025 \times 10^3)(9.8)(0.06) \\
= 1587.6 - 602.7 \\
= 984.9 \\
\therefore F_T = 984.9 \text{ N}
\]

(d) Will the tension in the hoisting cable increase, decrease, or remain the same if the plate accelerates upward at 0.05 m/s\(^2\)?

\[\checkmark\] increase \quad ____ decrease \quad ____ remain the same

Explain your reasoning.

\[
F_T + 602.7 - 1587.6 = 162(0.05) \\
F_T = 993 \text{ N}
\]

\[\therefore \] \text{F}_T \text{ increases} \\
\text{To accelerate upwards, force must increase.}

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GO ON TO THE NEXT PAGE.
6. (10 points)

A diver descends from a salvage ship to the ocean floor at a depth of 35 m below the surface. The density of ocean water is \(1.025 \times 10^3\) kg/m\(^3\).

(a) Calculate the gauge pressure on the diver on the ocean floor.

\[
P = \rho g h = (1.025 \times 10^3 \text{ kg/m}^3) (9.8 \text{ m/s}^2) (35 \text{ m})
\]

\[
= 4.52 \times 10^5 \text{ Pa}
\]

(b) Calculate the absolute pressure on the diver on the ocean floor.

\[
P = P_0 + \rho g h
\]

\[
1.0 \times 10^5 \text{ Pa} + (1.025 \times 10^3 \text{ kg/m}^3) (9.8 \text{ m/s}^2) (35 \text{ m})
\]

\[
= 4.52 \times 10^5 \text{ Pa}
\]
The diver finds a rectangular aluminum plate having dimensions 1.0 m \times 2.0 \text{ m} \times 0.03 \text{ m}. A hoisting cable is lowered from the ship and the diver connects it to the plate. The density of aluminum is $2.7 \times 10^3 \text{ kg/m}^3$. Ignore the effects of viscosity.

(c) Calculate the tension in the cable if it lifts the plate upward at a slow, constant velocity.

\[
\begin{align*}
F_B &= \rho V g \\
&= (2.7 \times 10^3)(1.0 \times 2.0 \times 0.03)(9.8) \\
&= 1587.6 \text{ N}
\end{align*}
\]

\[
T + F_B = mg
\]

\[
T = mg - F_B
\]

\[
162(9.8) - 1587.6 = 0
\]

(d) Will the tension in the hoisting cable increase, decrease, or remain the same if the plate accelerates upward at 0.05 m/s$^2$?

\[\checkmark \text{ increase} \quad \quad \checkmark \text{ decrease} \quad \quad \checkmark \text{ remain the same}\]

Explain your reasoning.

IF ACCELERATION INCREASES, SO WILL $T$.

IF THE MASS AND $F_B$ REMAIN THE SAME

$T_{\text{larger}} = ma \text{ larger}$

$a = 0.05 \text{ m/s}^2 \quad \quad \quad > 0 \text{ m/s}^2$

GO ON TO THE NEXT PAGE.