AP® Physics B
2003 Sample Student Responses

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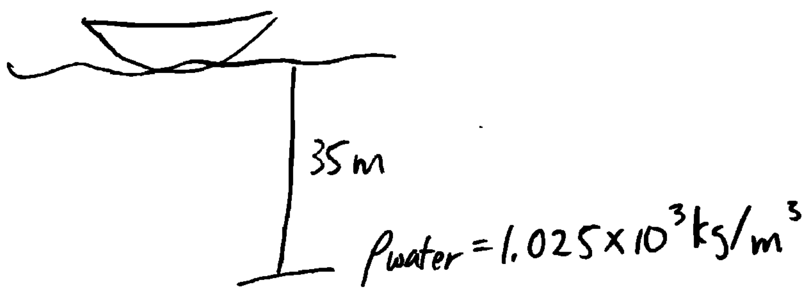
6. (10 points)

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 1.025×10^3 kg/m^3.

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



$P = \rho g h$

$= (1.025 \times 10^3 \text{ kg/m}^3)(9.8)(35)$

$= 351575 \text{ N/m}^2$

$\therefore P = 3.5 \times 10^5 \text{ Pa}$

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

$P = P_0 + \rho g h$

$= 1 \times 10^5 \text{ N/m}^2 + 351575 \text{ N/m}^2$

$= 451575 \text{ Pa}$

$\therefore P = 4.5 \times 10^5 \text{ Pa}$

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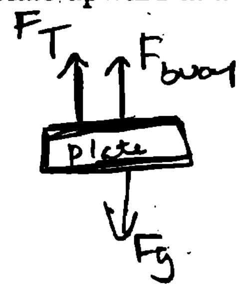
AA2

The diver finds a rectangular aluminum plate having dimensions 1.0 m × 2.0 m × 0.03 m. A hoisting cable is lowered from the ship and the diver connects it to the plate. The density of aluminum is 2.7×10^3 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.



$V = 0.06 \text{ m}^3$

$\rho_{al} = 2.7 \times 10^3 \text{ kg/m}^3$

$\rho = \frac{m}{V}$ $\quad m = \rho V$

$m_{al} = 162 \text{ kg}$

const velocity, $a = 0$

$F_T + F_{buoy} - F_g = ma$

$\therefore F_T = F_g - F_{buoy}$

$= 162(9.8) - (1.025 \times 10^3)(9.8)(0.06)$

$= 1587.6 - 602.7$

$= 984.9$

$\therefore F_T = 985 \text{ N}$

(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?

✓ increase ____ decrease ____ remain the same

Explain your reasoning.

$F_T + 602.7 - 1587.6 = 162(0.05)$

$F_T = 993 \text{ N}$

$\therefore F_T$ increases

To accelerate upwards, force must increase.

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AB1

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 1.025×10^3 kg/m^3.

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

$P = ~~P_0~~ + \rho g h$

$= ~~1.0\times10^5 Pa~~ + (1.025\times10^3 \frac{kg}{m^3})(9.8 \frac{m}{s^2})(35 m)$

$= ~~4.52\times10^5 Pa~~$ $= 3.52\times10^5 Pa$

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

$P = P_0 + \rho g h$

$1.0\times10^5 Pa + (1.025\times10^3 \frac{kg}{m^3})(9.8 \frac{m}{s^2})(35 m)$

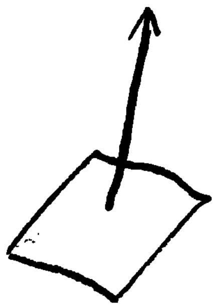
$= 4.52\times10^5 Pa$

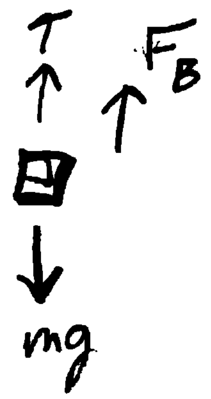
GO ON TO THE NEXT PAGE.

AB2 d=?

The diver finds a rectangular aluminum plate having dimensions 1.0 m × 2.0 m × 0.03 m. A hoisting cable is lowered from the ship and the diver connects it to the plate. The density of aluminum is 2.7×10^3 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.





CONSTANT V

$\therefore$ $a = 0$

MASS

$V = .06\,m^3$

$(2.7\times10^3)(.06)$

$m = 162$

$(m = dV)$

$T + F_B = mg$

$F_B = \rho V g$

$= (2.7\times10^3)(1.0\times2.0\times.03)(9.8)$

$F_B = 1587.6\,N$

$T = mg - F_B$

$162(9.8) - 1587.6$

$T = 0$ ...

(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?

✓ increase ____ decrease ____ remain the same

Explain your reasoning.

$T + F_B - mg = ma$

$T = ma + \cancel{mg} - \cancel{F_B}$ — (THE SAME)

IF ACCELERATION INCREASES, SO WILL T IF THE MASS AND F_B REMAIN THE SAME

$T_{LARGER} = ma_{LARGER}$ (PART C).

$a = .05\,m/s^2 > 0\,\frac{m}{s^2}$

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