Physics Exercise Static Fluid

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1 Introduction

Unfortunately, welcome back to this screen. Tomorrow, as of the date of 20th of February 2025, there will be a physics quiz that will be done, on the estimated time of 45 minutes. I also realised today that the practice isn't as easy as I expected, and in all honestly, I struggled doing this practice. Hence I am making this so you, dear reader won't be as fried as I am. As I said again, **please do take this with a grain of salt. I am not an expert, nor am I particularly good at this, please do this yourself and correct my mistakes.**

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3 No. 1 "Giraffe?"

1. Hitunglah selisih tekanan hidrostatik darah di antara otak dan kaki di dalam tubuh jerapah yang tingginya 4,2 meter. Anggap massa jenis darah 1,06 g/cm3 dan percepatan gravitasi 9,8 m/s2.

In this particular question, we are asked to find the difference of the hydrostatic pressure on the head of the giraffe and the feet of the giraffe. We are given that the height of the giraffe is 4.2 meters, furthermore the given gravity is an unfortunate $9.8m/s^2$, and that the density of the giraffe's blood is $1,06g/cm^3$, and converted into SI units, it is $1060kg/m^3$. Hence we use this formula,

$$\Delta P \rightarrow P_1 - P_2$$

Firstly finding P_1,

$$P_1 = \rho gh$$
$$P_1 = 1060 \times 9.8 \times 4.2$$
$$P_1 = 43629,6Pa$$

Secondly, finding P_2

$$P_2 = 1060 \times 9.8 \times 0$$
$$P_2 = 0$$

$$P_1 - P_2 = 43,629.6Pa$$

Hence the answer is **43,629.6 Pascals, or approximately 43,63 Kilopascals.**

4 No. 2 "Mechanical Engineering ahh mfs"

2. Sebuah dongkrak hidrolik yang mengandung minyak (massa jenis 0,8 g/cm3) memiliki luas silinder besar dan kecil berturur-turut adalah 0,5 m2 dan 0,0001 m2. Massa penghisap besar adalah M1= 50 kg, sedangkan massa penghisap kecil m tidak diketahui. Massa tambahan M = 450 kg diletakkan di atas penghisap besar dan dongkrak berada dalam keseimbangan dengan penghisap kecil berada pada ketinggian h = 1 di atas penghisap besar. Tentukan massa m.

So here is the figure, this will help with understanding what the question wants.

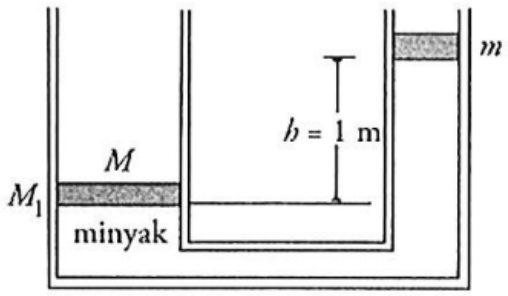


Figure 1: Mechanical Engineers, ya'll will have fun frfr

I prefer drawing over the figure, so it can help me with solving the answer, here is my diagram.

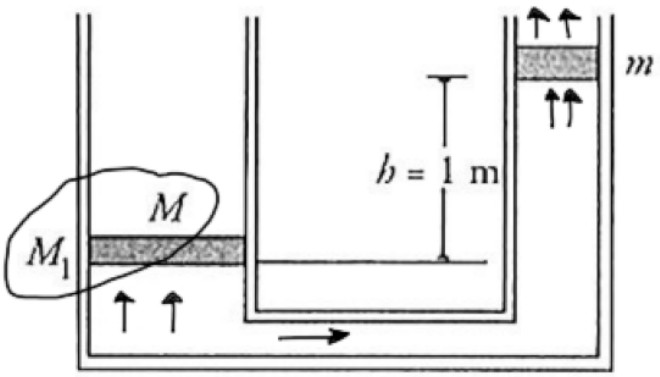


Figure 2: I'm taking aerospace so mine will be worse anyways :sob:

As we can see here, the pressure from M and M_1 is trying to resist the pressure that is help to push m. Hence I conclude that, it can be summarised such as this,

$$P_1 = P_2 + P_3$$

Because the formula of P is,

$$P = \frac{F}{A}$$

It becomes,

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} + P$$

Since force is just $m \times a$, and since a is gravity in this case, it is $10m/s^2$ according to the original instructions. What we already know is that, the mass of M and M_1 is combined, and hence making it a total of 500 kg, putting this in the formula,

$$\frac{M_1 * a_1}{A_1} = \frac{M_2 * a_2}{A_2} + P$$

Because Timo is scared of removing the a, I'll keep it.

$$\frac{500 * 10}{0.5} = \frac{m * 10}{0.0001} + 800 * 10 * 1$$

$$10,000 = \frac{10m}{0.0001} + 8000$$

$$2000 = \frac{10m}{0.0001}$$
$$0.2 = 10m$$
$$m = 0,02kg$$

As you can see Timo, removing the a will still cause the same answer, hence the answer is **0.02 kg.**

5 No. 3 "The Calm Before the Storm"

3. Tentukan gaya apung pada balok dengan ukuran 0,2 m x 0,1 m x 0,3 m jika dicelupkan:
   a. seluruhnya dalam minyak ($\rho = 800\ kg/m^3$)
   b. sepertiga bagian dalam raksa ($\rho = 13600\ kg/m^3$)
   c. 3/5 bagian dalam air laut ($\rho = 1025\ kg/m^3$)

The dimensions of this block is given, hence we can directly find the volume, and find the Fa of these questions. The volume given will be in,

$$0.2 \times 0.1 \times 0.3 = 0.006m^3$$

5.1 "Oiled up block"

$$Fa = \rho g V_{bf}$$
$$Fa = 800 \times 10 \times 0.006$$
$$Fa = 48N$$

5.2 "Does bro thinks he's Qin Shihuang?"

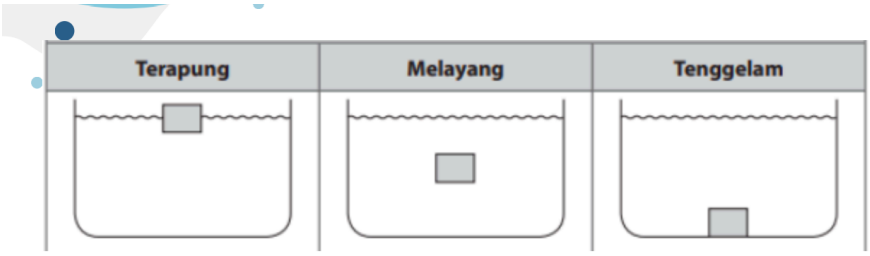
$$Fa = 13600 \times 10 \times 0.006 \times \frac{1}{3}$$
$$Fa = \frac{816}{3} \rightarrow Fa = 272N$$

5.3 "Swim."

$$Fa = 1025 \times 10 \times 0.006 \times \frac{3}{5}$$
$$Fa = \frac{61.5 \times 3}{5}$$
$$Fa = \frac{184.5}{5}$$
$$Fa = 36.9N$$

6 No. 4 "Fuck Theories frfr"

Honestly just use logic for this one, but instead of mass, use density. I mean if the density of water is larger than the density of wood, it will float correct? Same goes for other materials until the example sinks. Or,



$\rho_b < \rho_f$	$\rho_b = \rho_f$	$\rho_b > \rho_f$
$F_a > W$	$F_a = W$	$F_a < W$

7 No. 5 "Glub Glub Glub I'm Under the Water"

5. Benda yang volumenya 30 cm3, ketika ditimbang di dalam air laut menunjukkan massa semunya sebesar 240 gram. Jika massa jenis air laut 1,025 g/cm3, tentukan rapat jenis benda tersebut (asumsikan benda tenggelam)

Unfortunately the numbers would be horrific if converted to SI Units. But because we can use calculators, might as well, not to confuse people. Here is the formula for this,

$$W_{app} = W_{real} - Fa$$

As we remember from last topics,

$$W = mg$$

Putting this in,

$$mg_{app} = mg_{real} - Fa_{sea}$$
$$m_{app} = m_{real} - Fa_{sea}$$
$$m = \rho V - \rho g V_{bf}$$

In this case we are trying to find the object, hence it becomes,

$$m + \rho V_{bf} = \rho_{obj} V_b$$

And since it's underwater, the V_{bf} and the V_b is the same.

$$\frac{m + \rho V_{bf}}{V_b} = \rho_{obj}$$
$$\frac{m}{V_b} + \rho_{sea} = \rho_{obj}$$

Here comes the numbers...

$$\frac{0.24}{3 \times 10^{-5}} + 1025 = \rho_{obj}$$
$$8000 + 1025 = \rho_{obj} \rightarrow \rho_{obj} = 9025 kg/m^3$$

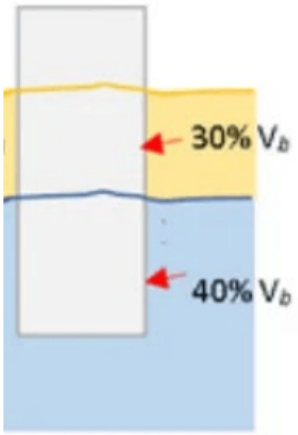
Hence, the answer to this question is $9025 kg/m^3$.

6. Sebuah benda terapung di atas permukaan air yang berlapiskan minyak dengan 40% volume benda berada di dalam air, 30% volume benda berada di dalam minyak, dan sisanya berada di atas permukaan minyak. Jika massa jenis minyak 0,8 gram/cm3. Hitunglah:
   a. massa jenis benda tersebut
   b. massa benda tersebut apabila volume benda 10 m3

If I recall correctly, the answer key for this question is wrong. Hence, I guess follow this one if you'd like.

7.1 "Sir Blundered :skull:"

Anyways, the diagram of the image can be something like this, where it's taken from sir's slides.



It is given that the density of oil is 800, and the density of water is always 1000, but since their only in a percentage amount of the casing, it must be multiplied by the percentage.

$$1000 \times 0.4 = 400$$

$$800 \times 0.3 = 240$$

The IPS kids would love this, now it's time to add these all together.

$$W = \Sigma Fa$$

$$m = 400 * V_b + 240 * V_b$$

$$m = 640V_b$$

$$\rho V_b = 640V_b$$

$$\rho = 640kg/m^3$$

7.2 "Finally, my torture is over"

Figure 3: me rn

$$\rho = \frac{m}{V}$$
$$640 \times 10 = m$$
$$m = 6400kg$$

And this is all for the practice, I hope you can do it. Anyways just remember the formulas and you should be fine.

Figure 4: Dassault Mercure