Density and Pressure - 2018

1. 9702/11/M/J/18/No.11
   Blocks P, Q, R and S are made from material of the same density. Block T is made from a material of twice the density of the material of the other blocks.

   The cross-sectional area and height of each of the blocks are shown.

   ![Diagram](https://www.megalecture.com)

   Which two blocks exert the same pressure on the ground?
   
   A) P and T  
   B) Q and R  
   C) Q and S  
   D) S and T

2. 9702/11/M/J/18/No.13
   Liquids X and Y are stored in large open tanks. Liquid X has a density of 800 kg m\(^{-3}\) and liquid Y has a density of 1200 kg m\(^{-3}\).

   At which depths are the pressures equal?

<table>
<thead>
<tr>
<th></th>
<th>depth in liquid X/m</th>
<th>depth in liquid Y/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>
3. 9702/12/M/J/18/No.10

The density of water is $1.0 \text{ g cm}^{-3}$ and the density of glycerine is $1.3 \text{ g cm}^{-3}$.

Water is added to a measuring cylinder containing $40 \text{ cm}^3$ of glycerine so that the density of the mixture is $1.1 \text{ g cm}^{-3}$. Assume that the mixing process does not change the total volume of the liquid.

What is the volume of water added?

A  $40 \text{ cm}^3$  B  $44 \text{ cm}^3$  C  $52 \text{ cm}^3$  D  $80 \text{ cm}^3$

4. 9702/12/M/J/18/No.12

A cylindrical block of wood has cross-sectional area $A$ and weight $W$. It is totally immersed in water with its axis vertical. The block experiences pressures $p_i$ and $p_b$ at its top and bottom surfaces respectively.

Which expression is equal to the upthrust on the block?

A  $(p_b - p_i)$
B  $(p_b - p_i)A$
C  $(p_b - p_i)A - W$
D  $(p_b - p_i)A + W$

5. 9702/13/M/J/18/No.11

A rectangular block of lead of density $1.13 \times 10^4 \text{ kg m}^{-3}$ has sides of length 12.0 cm, 15.0 cm and 10.0 cm.

What is the maximum pressure the block can exert when resting on a table?

A  $1.13 \text{ kPa}$  B  $1.70 \text{ kPa}$  C  $11.1 \text{ kPa}$  D  $16.6 \text{ kPa}$
6. 9702/13/M/J/18/No.10

Four cuboids with identical lengths, breadths and heights are immersed in water. The cuboids are held at the same depth and in identical orientations by vertical rods, as shown.

![Diagram of cuboids with different densities](image)

Water has density $\rho$.
Cuboid $W$ is made of material of density $4\rho$.
Cuboid $X$ is made of material of density $2\rho$.
Cuboid $Y$ is made of material of density $\rho$.
Cuboid $Z$ is made of material of density $0.5\rho$.

Which statement is correct?

A. The upthrust of the water on each of the cuboids is the same.
B. The upthrust of the water on $W$ is twice the upthrust of the water on $X$.
C. The upthrust of the water on $X$ is twice the upthrust of the water on $W$.
D. The upthrust of the water on $Y$ is zero.

7. 9702/13/M/J/18/No.13

Full-fat milk is made up of fat-free milk mixed with fat.

A volume of $1.000 \times 10^{-3}$ m$^3$ of full-fat milk has a mass of 1.035 kg. It contains 4.00% fat by volume.

The density of fat-free milk is $1.040 \times 10^3$ kg m$^{-3}$.

What is the density of fat?

A. $1.25 \times 10^2$ kg m$^{-3}$
B. $9.15 \times 10^2$ kg m$^{-3}$
C. $9.28 \times 10^2$ kg m$^{-3}$
D. $1.16 \times 10^3$ kg m$^{-3}$