

## **Matter and kinetic theory**

### **Exercises**

1.- A pond is 8 metres long, 4 metres wide and 50 cm deep. When we pour alcohol in it, the pond contains 12.6 tons of liquid. Find the density of alcohol. How much water can we pour in it?. How much mercury? Densities ( $\text{g} / \text{cm}^3$ ): water: 1; mercury: 13,6

**Sol: 788  $\text{kg.m}^{-3}$ ; 16 tons; 218 tons**

2.- The sides of a room are 8 and 5 metres and its height is 3,5 metres Find the mass of air contained in this room, if density of air is  $1.3 \text{ g} / \text{l}$ . Find the volumes of water and mercury with the same mass. Densities ( $\text{g} / \text{cm}^3$ ): water: 1; mercury: 13,6

**Sol: 182 kg; 140 tons; 1904 tons**

3.- A cardboard box is 50 cm high and its sides are 1 metre long. Find the density of alcohol, if the mass of the box filled with alcohol is 395 kg. Find the mass of the air contained in this box supposing that the density of air is  $0.0013 \text{ g/cm}^3$  **Sol:790  $\text{kg.m}^{-3}$ ;**

4.- A glass bottle of 75 cl is filled with alcohol. Find the mass of alcohol, if the density of alcohol is  $0.75 \text{ g/ml}$ . Find the volume occupied by the same amount of mass of carbon dioxide or mercury . Densities: Carbon dioxide:  $2 \text{ g} / \text{l}$ ; mercury:  $13.6 \text{ g/cm}^3$  **Sol: 592 g; 296 l; 43.5  $\text{cm}^3$**

5.- We have filled a balloon with half a litre of air at  $25^\circ \text{C}$ . Then we place this balloon on a heater. Find the volume of the balloon at  $35^\circ$ ,  $50^\circ$  and  $65^\circ \text{C}$  **Sol: 517, 542 & 567 ml**

6.- Imagine a syringe filled with 50 ml of nitrogen at 1 at. Find the pressure of the nitrogen contained in the syringe when we reduce the volume to 35 ml and 15 ml

**Sol: 1.43 at; 3.3 at**

7.- A pressure cooker can work at the pressure of 1.1 or 1.2 at. Find the temperature of the water vapour contained in the pressure cooker when we heat a meal at these pressures

**Sol: 137° C; 174 ° C**

8.- We fill a tyre with air getting a pressure of 2.23 atmospheres at  $25^\circ \text{C}$ . Then the car starts to move and the tyres become hot. Find the pressure of the tyres at  $50^\circ \text{C}$  and  $75^\circ \text{C}$

**Sol: 2,41 at; 2,6 at**

9.- A 1000 litre-balloon is filled with helium at room temperature ( $25^\circ \text{C}$ ) and 1 at. Then it rises up and arrives to 36000 m high. Find the volume of the balloon:

- a) at 10000 m high, where pressure is 0,2 at and temperature is  $-20^\circ \text{C}$
- b) at 40000 m high, where pressure is 0,01 at and temperature is  $-60^\circ \text{C}$
- c) at 60000 m high, where pressure is 0,001 and temperature is  $10^\circ \text{C}$

10.- A bubble of air rises up from a submarine which is placed at 500 m of depth. Calculate its volume when it reaches to the surface of the sea at  $15^\circ \text{C}$  and 1 at, if it had  $1 \text{ cm}^3$  of volume at 7 at of pressure and  $10^\circ \text{C}$

11. Plot the heating graph of ethanol from 200 K to 400 K. Melting point of alcohol is and its boiling point is  $79^\circ \text{C}$