

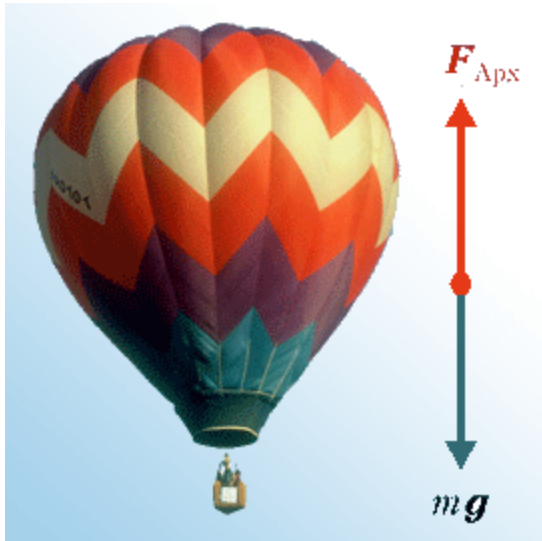
Answer on Question #42610, Physics, Mechanics | Kinematics | Dynamics

Conditions:

1) A balloon is released from a tall building. The total mass of the balloon including the enclosed gas is $m=2.0$ kg. Its volume is $V=5.0$ m³. The density of air is $\rho=1.3$ kg/m³.

The most probable questions: what the resulting force acting on the balloon ($F=?$); what acceleration has the balloon without extra weight ($a=?$); what maximum weight can be carried by the balloon ($M_{max}=?$).

Solution:



The balloon will lift his own weight ($m * g$) and a force due to Archimedes' principle

$$F_{arch} = \rho * V * g;$$

$$\text{Resulting force: } F = F_{arch} - mg = \rho * V * g - mg = (\rho * V - m) * g = 45 \text{ N};$$

$$\text{The acceleration of the balloon has up direction: } ma = F; \quad a = F/m = 22.5 \text{ m/s}.$$

$$\text{Maximum weight that can be carried with the balloon: } M_{max} = F/g = 4.5 \text{ kg}.$$

Answer: $F = 45 \text{ N}$; $a = 22.5 \text{ m/s}$; $M_{max} = 4.5 \text{ kg}$.