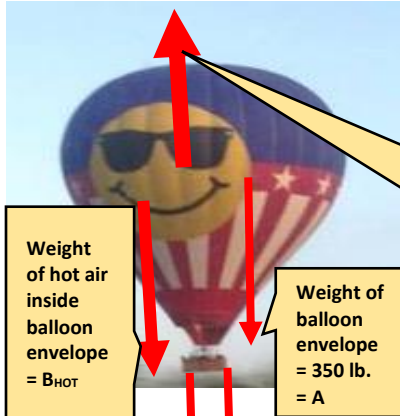


# FLUIDS

Unit 18 Dr. John P. Cise, Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx.

78701 & New York Times , July 31, 2016 by David Montgomery & Christine Hauser

## Hot-Air Balloon Crash in Texas Kills 16, Officials Say



Investigators near the site of a hot-air balloon crash on Saturday near Lockhart, Tex. The National Transportation Safety Board will lead the inquiry.

**INTRODUCTION:** Purpose of this application is to show the buoyant force due to weight of cool air displaced is adequate to support the four down forces ON Balloon. Consider the density of hot(120° F) and cold(70° F) air at 14.7 lb./inch<sup>2</sup> to be the average of density at 120° F and 70° F.

**QUESTIONS:** (a) Find density of 70° cool air at 14.7 psi? (b) Find density of 120° Hot air at 14.7 psi? (c) This balloon has a radius of 42 ft.. Find volume of balloon? (d) Find weight of 70° cool air displaced by balloon envelope =  $B_{COOL} = ?$  (e) Find weight of 120° hot air inside balloon envelope =  $B_{HOT} = ?$ , (f) Find total weight down of: Gondola & ropes(B) + Weight of balloon envelope(A) + Total weight of 16 guests(ave. 210 lb. each with their gear)(C) ? (g) Find  $F_{NET Y} = ?$ , (h) comment on (f)?

**HINTS:** Density = weight/V ,  $V_{SPHERE} = 4/3 \pi R^3$  , Archimedes principle = objects are buoyed up by a force equivalent to weight of fluid displaced.

**ANSWERS:** (a) 0.1515 lb./ft.<sup>3</sup> , (b) 0.1385 lb./ft.<sup>3</sup> , (c) 310,338 ft.<sup>3</sup> , (d) 47,016 lb. (e) 42,982 lb., (f) 4034 lb., (g)  $F_{NET Y} = 0$  , (h) Sum of forces ON balloon should add up to zero to be in equilibrium. Thus, the balloon is in equilibrium and not going up or down.

Density of air 1) (lb/ft<sup>3</sup>)

Air temperature (oF)	Gauge Pressure (psi)											
	0	5	10	20	30	40	50	60	70	80	90	100
30	0.081	0.109	0.136	0.192	0.247	0.302	0.357	0.412	0.467	0.522	0.578	0.633
40	0.080	0.107	0.134	0.188	0.242	0.295	0.350	0.404	0.458	0.512	0.566	0.620
50	0.078	0.105	0.131	0.185	0.238	0.291	0.344	0.397	0.451	0.504	0.557	0.610
60	0.076	0.102	0.128	0.180	0.232	0.284	0.336	0.388	0.440	0.492	0.544	0.596
70	0.075	0.101	0.126	0.177	0.228	0.279	0.330	0.381	0.432	0.483	0.534	0.585
80	0.074	0.099	0.124	0.174	0.224	0.274	0.324	0.374	0.424	0.474	0.524	0.574
90	0.072	0.097	0.121	0.171	0.220	0.269	0.318	0.367	0.416	0.465	0.515	0.564
100	0.071	0.095	0.119	0.168	0.216	0.264	0.312	0.361	0.409	0.457	0.505	0.554
120	0.069	0.092	0.115	0.162	0.208	0.255	0.302	0.348	0.395	0.441	0.488	0.535
140	0.066	0.089	0.111	0.156	0.201	0.246	0.291	0.337	0.382	0.427	0.472	0.517
150	0.065	0.087	0.109	0.154	0.198	0.242	0.287	0.331	0.375	0.420	0.464	0.508
200	0.060	0.081	0.101	0.142	0.183	0.225	0.265	0.306	0.347	0.388	0.429	0.470
250	0.056	0.075	0.094	0.132	0.170	0.208	0.246	0.284	0.322	0.361	0.399	0.437
300	0.052	0.070	0.088	0.123	0.159	0.195	0.230	0.266	0.301	0.337	0.372	0.408
400	0.046	0.062	0.078	0.109	0.141	0.172	0.203	0.235	0.266	0.298	0.329	0.360
500	0.041	0.056	0.070	0.098	0.126	0.154	0.182	0.210	0.238	0.267	0.295	0.323
600	0.038	0.050	0.063	0.089	0.114	0.140	0.165	0.190	0.216	0.241	0.267	0.292

LOCKHART, Tex. — A hot-air balloon carrying 16 people caught fire and crashed in Central Texas on Saturday, officials said, and the local authorities said no one had survived. The balloon crashed in a pasture near Lockhart, a town about 30 miles south of Austin, said Lynn Lunsford, a spokesman for the Federal Aviation Administration. Initial reports from officials said the balloon had plummeted after catching fire in the air, but at least one witness said it might have struck high-tension power lines before hitting the ground and bursting into flames. The accident occurred shortly after 7:40 a.m., Mr. Lunsford said.