

## TAP 402-3: 'Data from the Apollo 11 mission'

Events	Ground elapsed time / hours:minutes:seconds		Distance $r$ from centre of Earth / $10^6$ m	Velocity $v$ / $\text{m s}^{-1}$
launch from surface of Earth	00:00:00			
ignition to inject into coasting orbit to Moon (5 m 20 s burn)	02:44			
coasting begins with no rocket burn	03:08:00	1	11.054	8406
10 minute =	03:58:00	2	26.306	5374
600 s interval	04:08:00	2A	29.030	5102
10 minute =	05:58:00	3	54.356	3633
600 s interval	06:08:00	3A	56.368	3560
10 minute =	09:58:00	4	95.743	2619
600 s interval	10:08:00	4A	97.242	2594
10 minute =	19:58:00	5	169.900	1796
600 s interval	20:08:00	5A	170.945	1788
no rocket burn until this time	26:44:57.92	6	209.228	1531.56
3.55 second burn	26:45:01.47	7	209.232	1527.16
10 minute =	32:58:00	8	240.624	1356
600 s interval	33:08:00	8A	241.417	1352
Landing on Moon. Moon walk.				
Rocket burn to return	150:28			
Coasting back to Earth				
10 minute =	166:38:00	9	241.637	1521
600 s interval	166:48:00	9A	240.740	1524
10 minute =	172:18:00	10	209.722	1676
600 s interval	172:28:00	10A	208.737	1681
10 minute =	178:28:00	11	170.891	1915
600 s interval	178:38:00	11A	169.766	1923
10 minute =	187:58:00	12	96.801	2690
600 s interval	188:08:00	12A	95.241	2715
10 minute =	191:48:00	13	56.368	3626
600 s interval	191:58:00	13A	54.310	3699
10 minute =	193:48:00	14	28.427	5201
600 s interval	193:58:00	14A	25.640	5486
10 minute =	194:38:00	15	13.311	7673
600 s interval	194:48:00	15A	10.036	8854
Rocket burn on re-entry	195:03			

### **Practical advice**

These data are selected from a huge printout supplied by NASA. More of the data is provided here so that it can be looked at and discussed, and so that further analyses can be done. We think that there is also some interest in imagining the whole mission, which is why times during the nearly 200 hour mission are included.

The exercise also provides students with further opportunities to think about the most effective graph to plot. It is worth insisting that graphs have captions that convey their intended message.

### **Alternative approaches**

You may, especially with a class lacking in confidence, find it useful to print out the data for everyone, and look through them together, talking about what is happening at each stage.

### **Social and human context**

NASA's raw data were actually provided with distances in nautical miles above the surface of the Earth, and with velocities in knots.

### **External reference**

This activity is taken from Advancing Physics chapter 11, 160T