Supplementary Information for

Computational Sedimentation Modelling Calibration: a tool to measure the settling velocity at different gravity conditions

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Description of Supplementary Tables and Figures.

Supplementary Table 1 shows the calculations performed to ensure that the image analysis procedure used to calculate the terminal velocity was correct. Supplementary Tables 2,3, and 4 summarize the data used to calculate the terminal velocity for hyper, Martian, and lunar gravity, respectively, using the least squares method. Supplementary Figures 1-16 show the vertical position of each sample in function of time, the Least Squares function and the R2 value for each set of data. Finally, terminal velocity, Reynolds number and drag coefficient as computed from the set of data obtained by applying the least square method to the range of data extracted by video analysis.

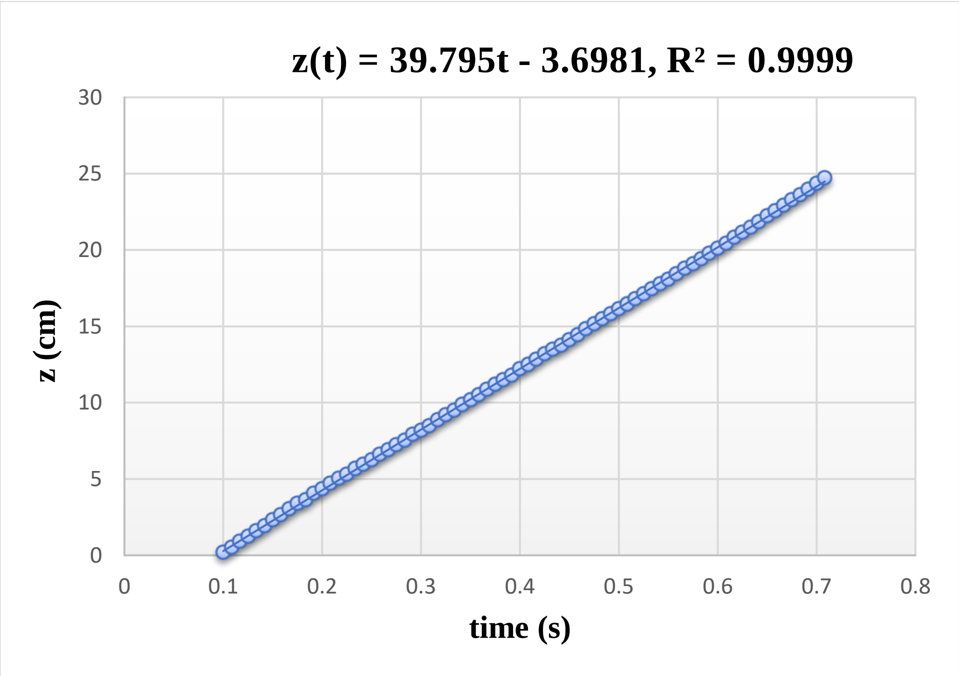
Supplementary Table 1: Comparison between the terminal velocity calculated by eye counting frames, the number of frames (NOF) and the corresponding equation calculated by the least squares method. The distance traveled by a particle in the central part of the sedimentation chamber, $\Delta z = Z_f - Z_i$, is divided by the time, calculated as nof divided by the camera frequency (120 fps), $\Delta t = NOF/120$. This yields the velocity $w = \Delta z/\Delta t$. As can be seen, there are no great fluctuations in the number of frames, and the absolute error between the terminal velocity values calculated by counting the number of frames and the least squares method is compresed between 0.66 and 0.2 cm·s^{-1} for Chamber 1 (CH1), 1.05 and 0.04 cm·s^{-1} for Chamber 2 (CH2), and 0.39 and 0.08 2 cm·s^{-1} for Chamber 4 (CH4). The comparison shows that the automated procedure provides reliable results and can be used to calculate terminal velocities at different gravities.

CH1	**Z_i (cm)**	**Z_f (cm)**	**Δz (cm)**	**NOF**	**w (cm·s^{-1})**	**Equation from linear regression**
1/10	10.9696	13.16763	2.19803	8	32.970	z(t) = 33.279t - 3.7672
2/10	10.80526	12.90058	2.09532	8	31.429	z(t) = 30.937t - 4.9022
3/10	10.86689	12.94166	2.07477	8	31.126	z(t) = 31.142t - 6.5341
4/10	10.80526	12.81841	2.01315	7	34.511	z(t) = 34.247t - 8.8405
5/10	10.88743	13.00329	2.11586	7	36.272	z(t) = 36.477t - 11.337
6/10	10.84634	13.06491	2.21857	8	33.278	z(t) = 33.566t - 9.8829
7/10	10.88743	13.02383	2.1364	7	36.624	z(t) = 36.771t - 12.178
8/10	11.01068	13.16763	2.15694	8	32.354	z(t) = 32.95t - 9.0754
9/10	10.9696	13.106	2.1364	8	32.046	z(t) = 31.389t - 9.6293
10/10	10.80526	12.92112	2.11586	9	28.211	z(t) = 28.819x - 9.594
CH2	**Z_i (cm)**	**Z_f (cm)**	**Δz (cm)**	**NOF**	**w (cm·s^{-1})**	**Equation from linear regression**
1/10	10.90116	13.12292	2.22176	9	29.623	z(t) = 29.795t - 3.2411
2/10	10.8804	12.97757	2.09718	8	31.456	z(t) = 32.184t - 4.909
3/10	10.81811	12.99834	2.18023	8	32.703	z(t) = 32.517t - 6.5375
4/10	10.81811	12.91528	2.09718	9	27.962	z(t) = 27.922t - 4.0555
5/10	10.8804	12.97757	2.09718	8	31.456	z(t) = 30.399t - 6.8503
CH4	**Z_i (cm)**	**Z_f (cm)**	**Δz (cm)**	**NOF**	**w (cm s^{-1})**	**Equation from linear regression**
1/10	10.93109	13.04348	2.112387	8	31.685	z(t) = 31.296t - 2.0834
2/10	11.05177	13.14708	2.09532	8	31.429	z(t) = 31.306t - 1.739
3/10	10.88743	13.08546	2.19803	9	29.307	z(t) = 28.909t - 4.2706

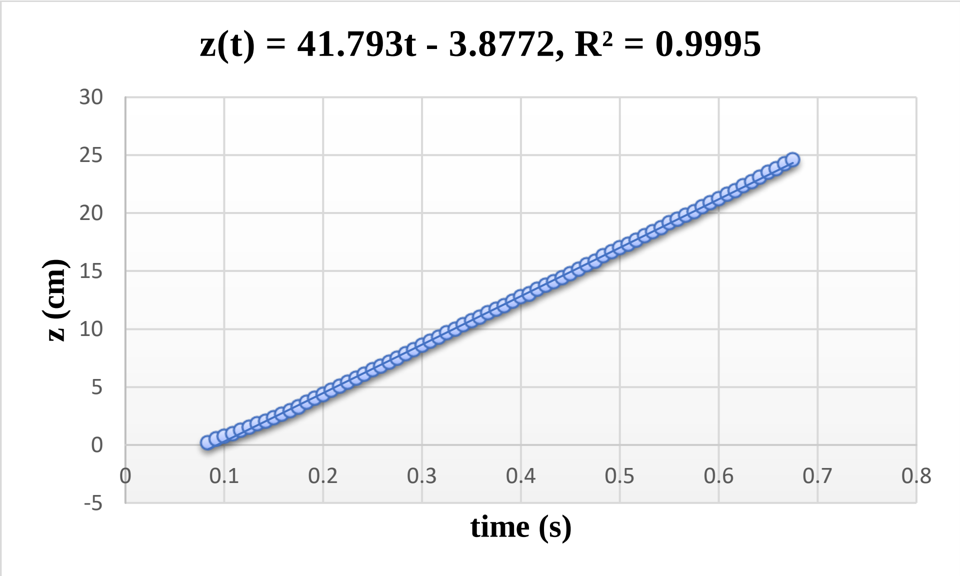
4/10	10.92851	13.02383	2.09532	8	31.429	z(t) = 31.512t - 4.8211
5/10	10.88743	12.90058	2.01315	8	30.197	z(t) = 30.033t - 6.3897

Supplementary Table 2: Summary data of the samples in hypergravity. Column 2 and 3 show the range of time and distance, respectively, from which the terminal velocity is calculated by the least squares method. For completeness, the last column shows the range of gravity values recorded by the gravity logger, with a frequency of 1/10 Hz. For each sample, a figure of the position of a particle is shown as a function of time below. Each figure also shows the function obtained by applying the least squares method to the data set and the value of R2. As can be seen, the value of R2 is very close to 1, indicating that the linear regression fit very well with the measured data, and that the particles has actuatty reached a constant terminal velocity.

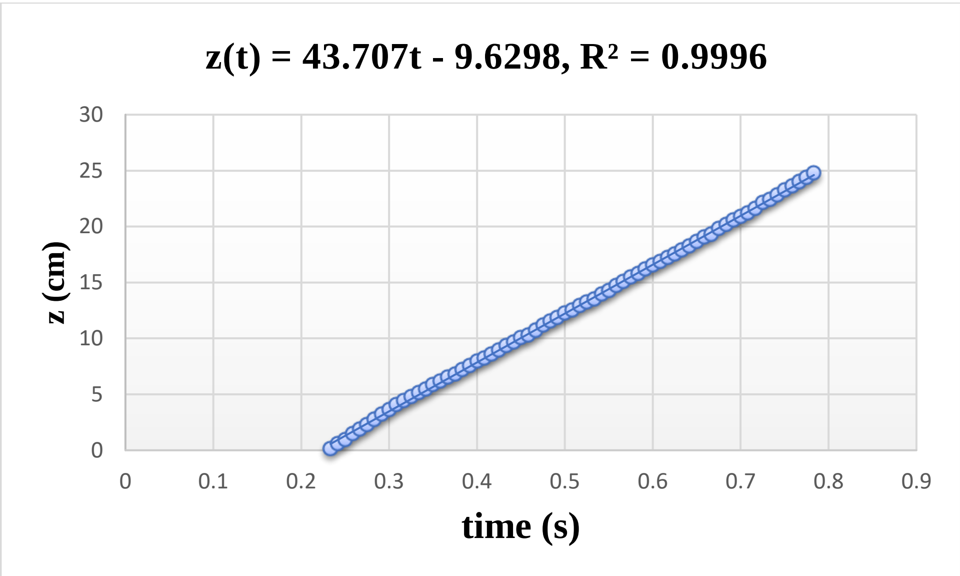
Hyper gravity	Range of time (s)	Range of distance (cm)	Range of gravity (m s^{-2})
Sample 1	0.1 – 0.7083	0.206 – 24.733	15.865 – 16.765
Sample 1/5	0.083 – 0.675	0.186 – 24.628	16.814 – 17.471
Sample 2/5	0.233 – 0.783	0.165 –24.793	16.814 – 17.716
Sample 3/5	0.241 – 0.775	0.165 – 24.627	16.814 – 17.716
Sample 4/5	0.250-0.775	0.0413– 24.627	18.586 – 19.593
Sample 5/5	0.4 – 0.958	0.124 – 24.793	17.110 – 17.691



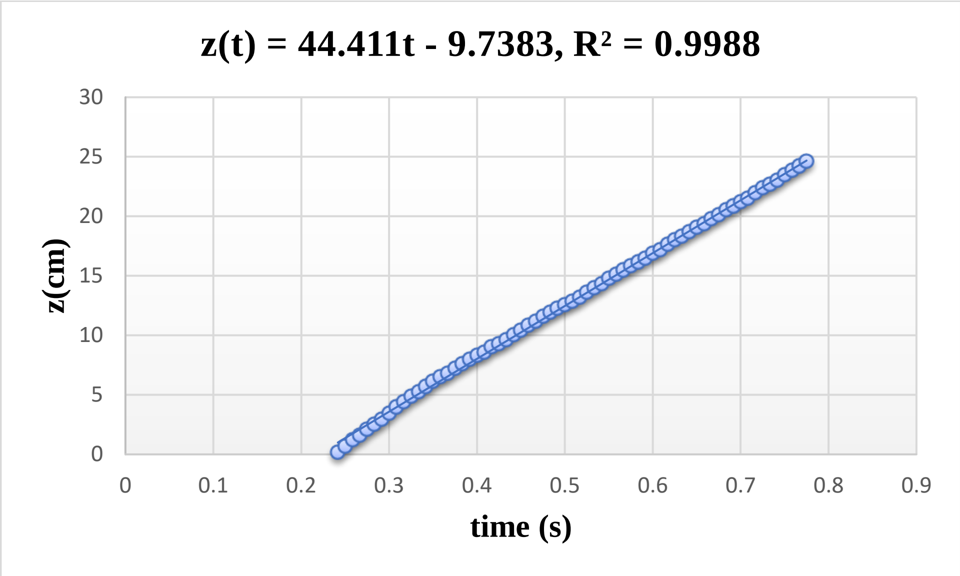
Supplementary Figure 1: Sample Hyper 1



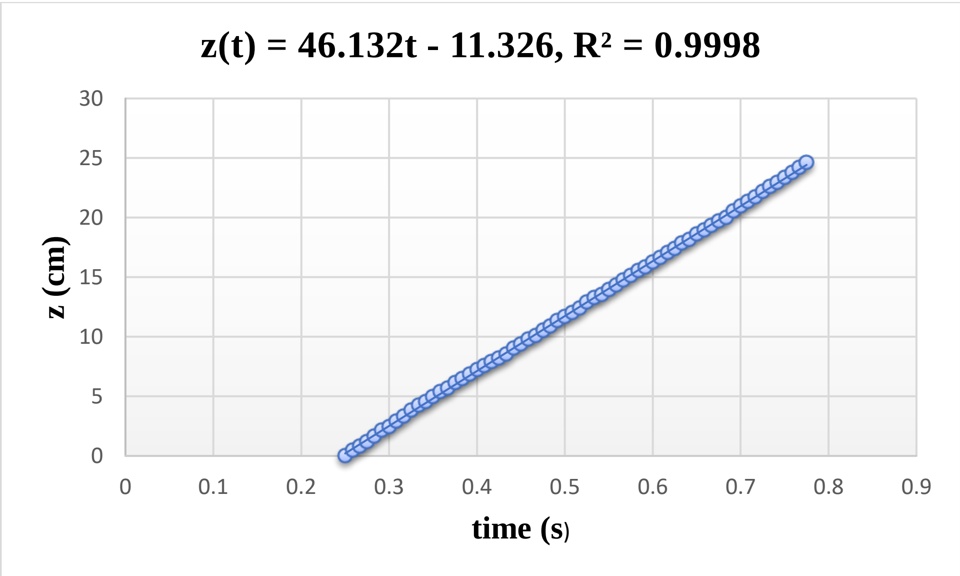
Supplementary Figure 2: Sample Hyper 1/5



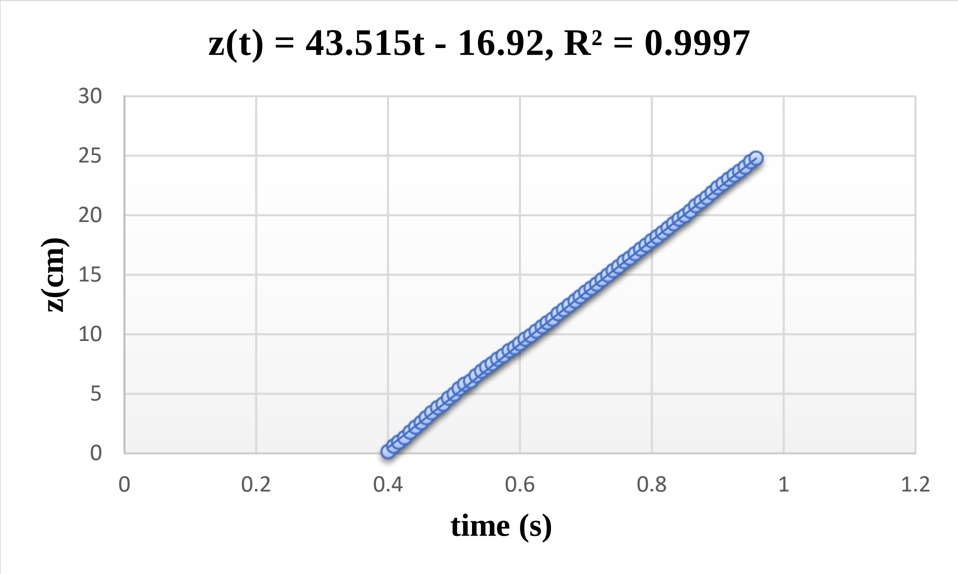
Supplementary Figure 3: Sample Hyper 2/5



Supplementary Figure 4: Sample Hyper 3/5



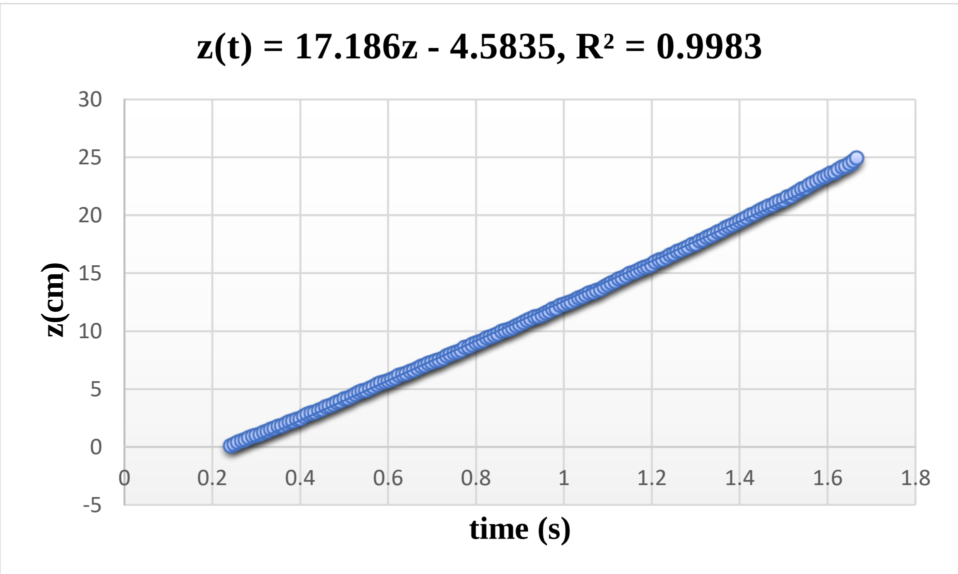
Supplementary Figure 5: Sample Hyper 4/5



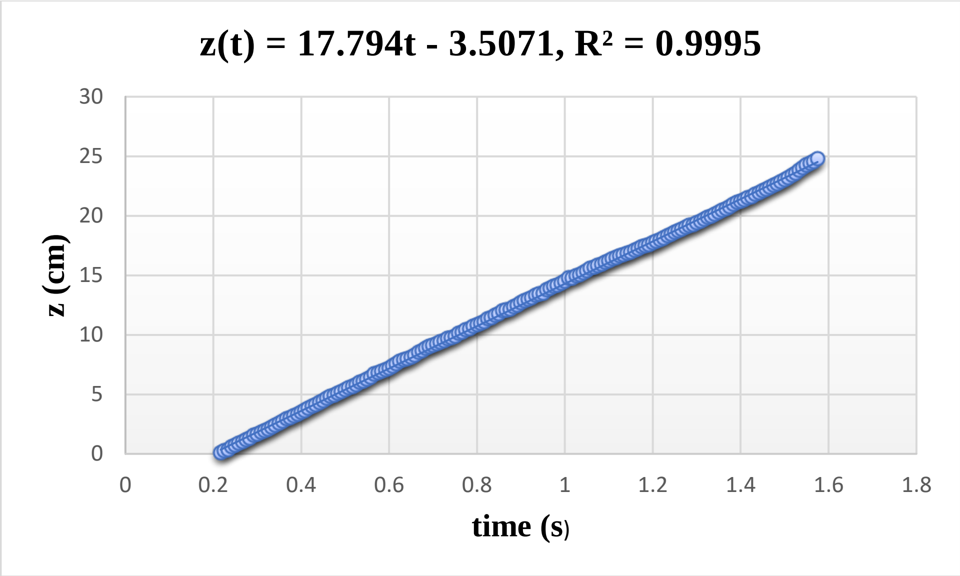
Supplementary Figure 6: Sample Hyper 5/5

Supplementary Table 3: Summary data of the samples in Martian gravity (see Supplementary Table 2).

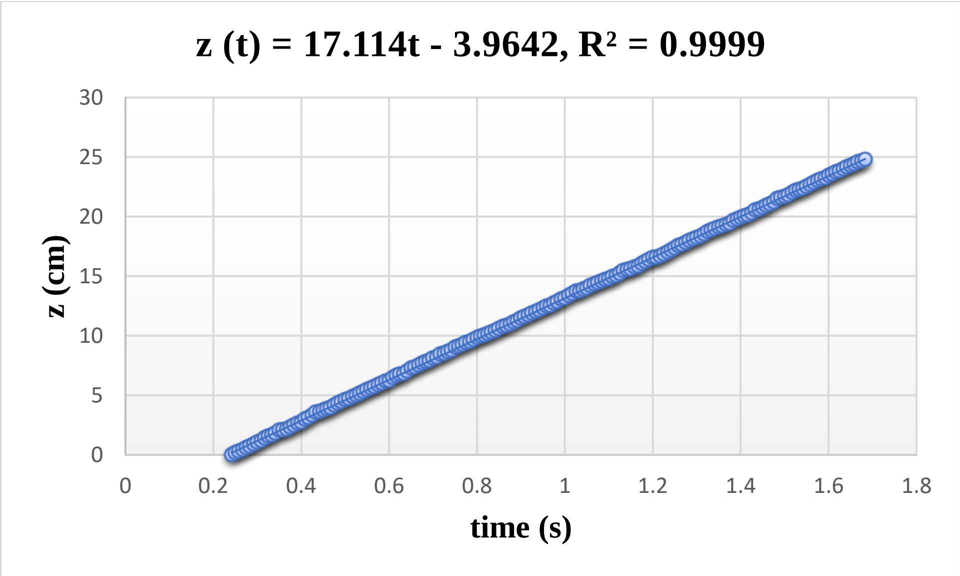
Martian gravity	Range of time (s)	Range of distance (cm)	Range of gravity (m s^{-2})
Sample 1	0.241 - 1.666	0.102 - 24.917	3.476 - 4.411
Sample 1/5	0.216 - 1.575	0.103 - 24.814	4.085 – 3.780
Sample 2/5	0.241 - 1.683	0.041 - 24.813	4.085 - 3.780
Sample 3/5	0.258 - 1.566	0.206 - 24.834	4.085 – 3.780
Sample 4/5	0.258 - 1.616	0.124 - 24.896	0.416 - 0.385
Sample 5/5	0.216 - 1.55	0.041 - 24.855	3.792 - 4.378



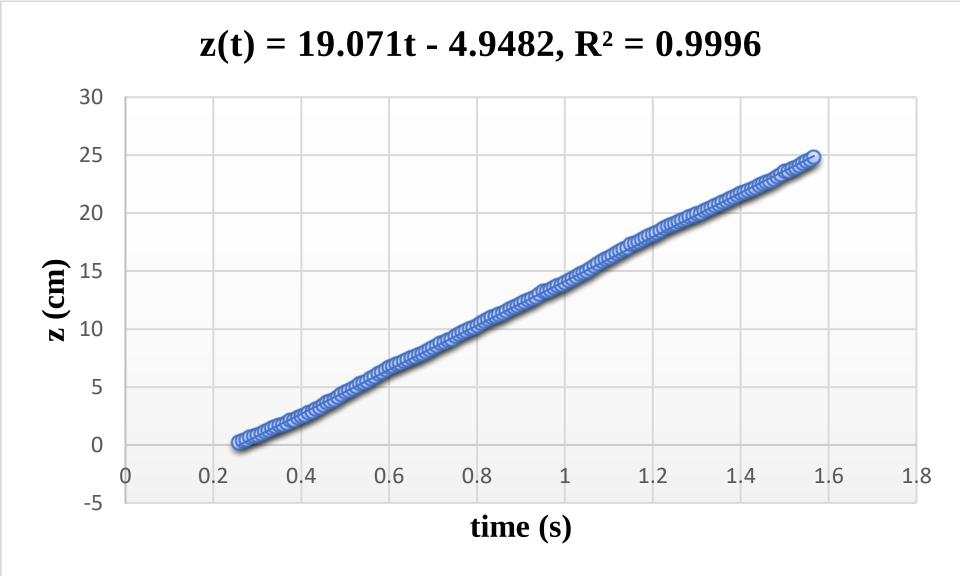
Supplementary Figure 7: Sample Mars 1



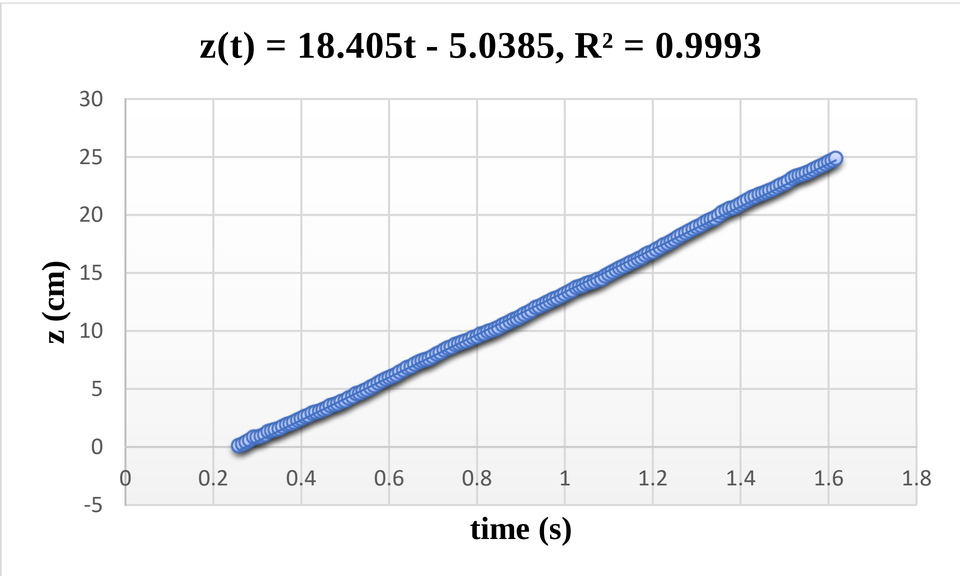
Supplementary Figure 8: Sample Mars 1/5



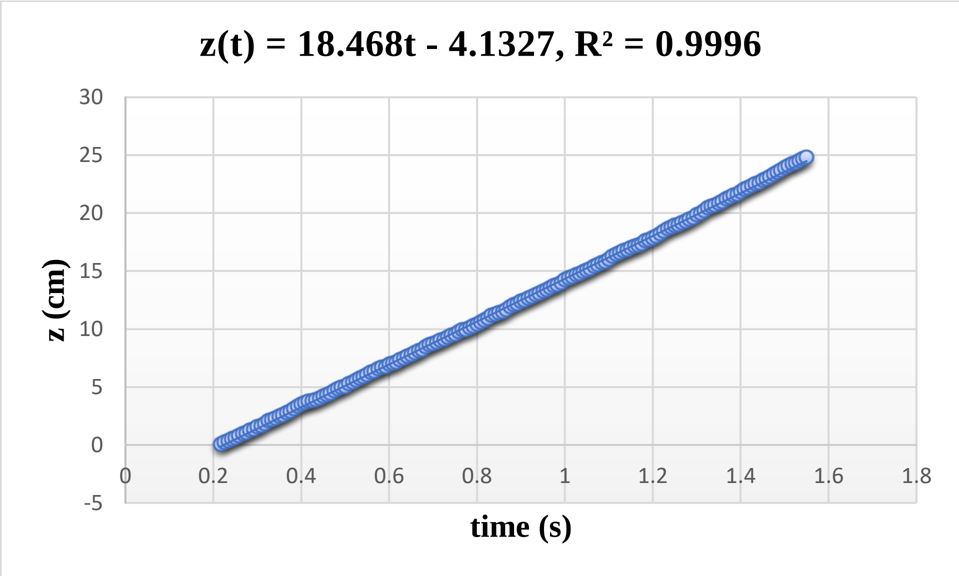
Supplementary Figure 9: Sample Mars 2/5



Supplementary Figure 10: Sample Mars 3/5



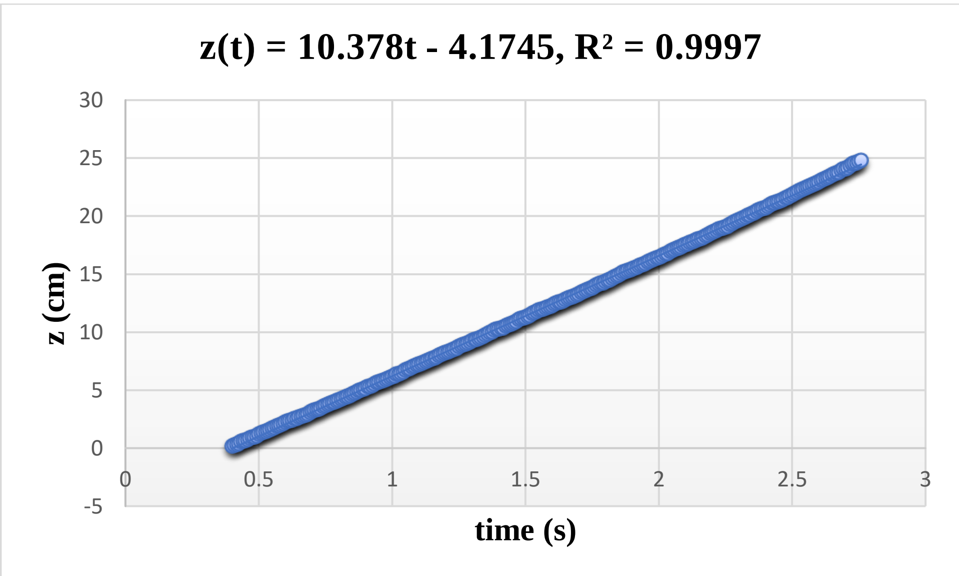
Supplementary Figure 11: Sample Mars 4/5



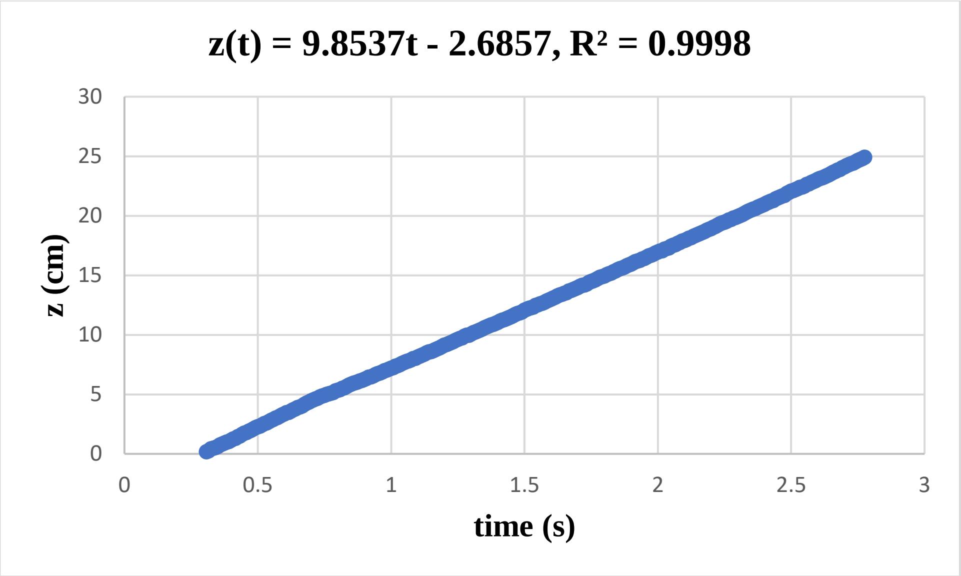
Supplementary Figure 12: Sample Mars 5/5

Supplementary Table 4: Summary data of the samples in Martian gravity (see Supplementary Table 2 and 3)

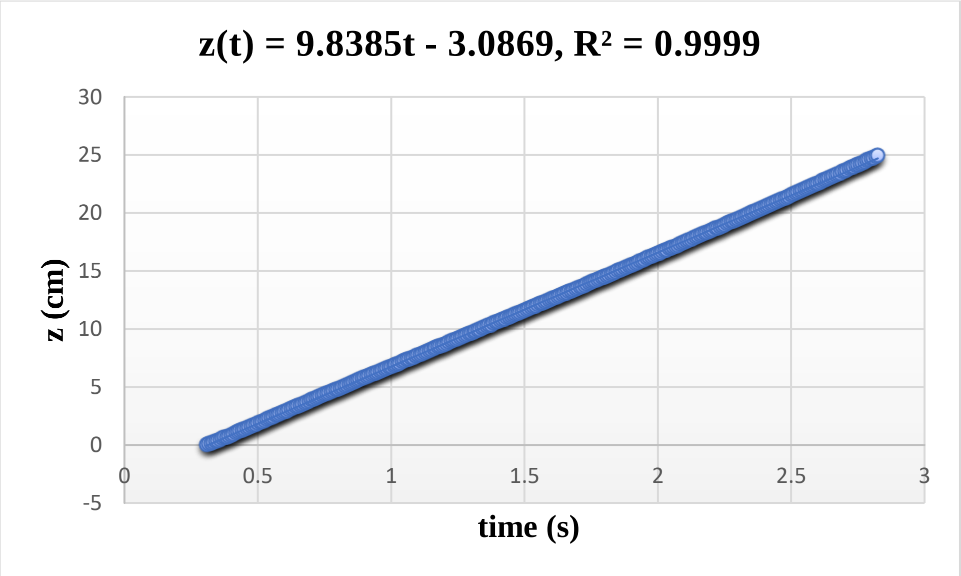
Lunar gravity	Range of time (s)	Range of distance (cm)	Range of gravity (m s^{-2})
Sample 1	0.4 - 2.758	0.165 - 24.813	2.040 - 2.017
Sample 1/3	0.308 - 2.775	0.164 - 24.897	1.159 - 1.992
Sample 2/3	0.308 - 2.825	0.041 - 24.979	0.118 - 0.2
Sample 3/3	0.366 - 2.716	0.082 - 24.917	2.063 - 1.991



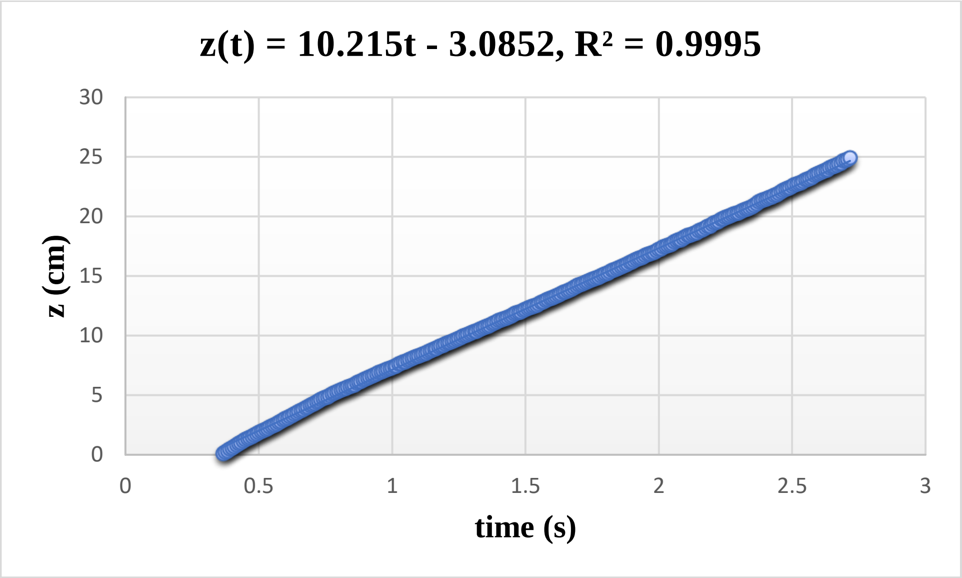
Supplementary Figure 13: Sample Moon 1



Supplementary Figure 14: Sample Moon 1/3



Supplementary Figure 15: Sample Moon 2/3



Supplementary Figure 16: Sample Moon 3/3

Supplementary Table 5: Terminal velocity, Reynolds number and Drag coefficient for each sample and each acceleration gravity. The terminal velocity are calculated using the Least Squares method applied to the set of data reported in Supplementary Tables 2-4. The value of gravity is extracted by the gravity logger.

Sample (Hyper)	**Gravity (m s^{-2})**	**w (cm s^{-1})**	**Re**	**C_d**
Sample 1	16.2	39.8	764.3	0.38
Sample 1/5	17.0	41.8	802.7	0.36
Sample 2/5	17.2	43.7	839.2	0.33
Sample 3/5	17.2	44.4	852.6	0.32
Sample 4/5	17.2	46.1	885.3	0.30
Sample 5/5	17.5	43.5	835.3	0.34
Mean samples 1-5/5	17.2	43.9	843	0.34
Standard deviation 1-5/5	0.16	1.6	29.9	0.02
Sample (Mars)	**Gravity (m s^{-2})**	**w (cm s^{-1})**	**Re**	**C_d**
Sample 1	3.80	17.2	330.3	0.48
Sample 1/5	3.95	17.8	341.8	0.46
Sample 2/5	3.93	17.1	328.4	0.50
Sample 3/5	3.94	19.1	366.8	0.40
Sample 4/5	3.94	18.4	353.3	0.43
Sample 5/5	4.02	18.5	355.3	0.44
Mean samples 1-5/5	3.96	18.2	349.1	0.45
Standard deviation 1-5/5	0.04	0.8	14.6	0.04
Sample (Moon)	**Gravity (m s^{-2})**	**w (cm s^{-1})**	**Re**	**C_d**
Sample 1	1.91	10.4	199.7	0.66
Sample 1/3	1.91	9.9	190.1	0.73
Sample 2/3	1.91	9.8	188.2	0.73
Sample 3/3	1.91	10.2	195.7	0.68

Mean samples 1-3/3	1.91	9.97	191.3	0.71
Standard deviation 1-3/3	0	0.21	3.9	0.03