

SUMMARY SHEET

EXPERIMENT 1

1. FOR WATER AND RED LIGHT AT EXTREME END OF SPECTRUM

$k = 1$	First Order Rainbow	$\theta_1 = 129.0^\circ$	$\phi_1 = 137.0 \pm 5.0^\circ$
$k = 2$	Second Order Rainbow	$\theta_2 = 129.0^\circ$	$\phi_2 = 231.0 \pm 3.0^\circ$
$k = 5$	Fifth Order Rainbow	$\theta_5 = 126.0^\circ$	$\phi_5 = 486.0 \pm 4.0^\circ$

2. LIQUIDS A AND B USING SECOND ORDER RAINBOWS

For Liquid A	$\theta_2 = 105.0^\circ$	$\phi_2 = 255.0 \pm 3.0^\circ$
For Liquid B	$\theta_2 = 89.5^\circ$	$\phi_2 = 270.5 \pm 3.0^\circ$
For $n = 1$	$\theta_2 = 0.0^\circ$	$\phi_2 = 0.0^\circ$
Gradient of graph		$= 0.84 \pm 0.07$
Extrapolated, $n = 2$,	θ_2 , value of ϕ	$= 304 \pm 25^\circ$

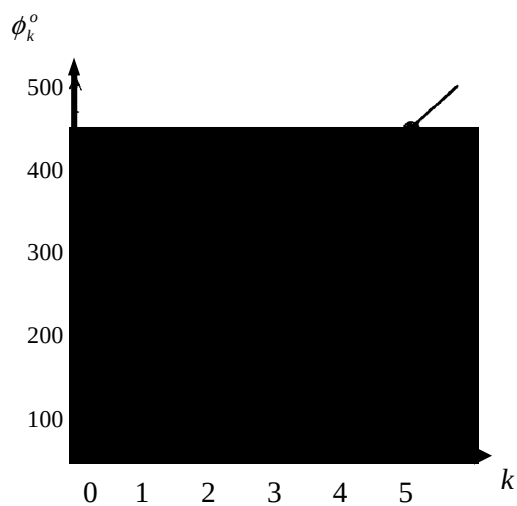


Figure E 1.1.

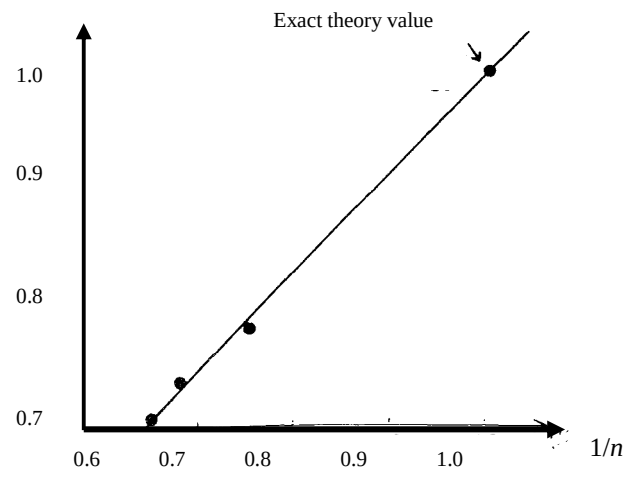


Figure E 1.2

SUMMARY SHEET

EXPERIMENT 2

Is the total momentum conserved?

YES / ~~NO~~

Accuracy of computer calculation

$$100 \frac{0.0000018}{0.1} \approx 0.002\% \text{ 0:1}$$

(RMS velocity = 0.1)

Time	Total Energy
0	-1.61499
2	-1.62886
4	-1.62878
6	-1.62301
12	-1.62882
18	-1.62599
24	-1.62796
30	-1.62703
50	-1.62753
70	-1.62676
90	-1.62580
130	-1.62713
180	-1.62409

Does the system conserve energy?

YES / ~~NO~~ ($\sim \pm 1\%$)Equilibrium value of E_k^* (Average 24 to 180) = 0.534 ± 0.05 Equilibrium time SD (see Fig. E 2.1) $\cong (10 \text{ to } 20) \times 0.1$ Value of S recorded > 20 , e.g. 60Value of α
(for $SD=60$) (see Fig. E2.2) = 0.503Accuracy of α = ± 0.02

For what time number range is graph, obtained using first value of SR, linear? SZ = 18 to 24

Gradient of this graph in linear region	$\cong 0.027$ to 0.47
Accuracy of gradient	$= 0.002$
Gradient of AVERAGE $\langle R^2 \rangle$ in linear region	$= 0.035$
Accuracy of this gradient	$= \pm 0.01$
* delete as appropriate	
Is the system a liquid/solid?	Liquid/ Solid *

Mean Momentum of the system at requested steps (S)

S	$\langle VX,1 \rangle$	$\langle VY,1 \rangle$	$\langle PX \rangle$	$\langle PY \rangle$
0	0.0000000	0.0000000	0.0000000	0.0000000
40	0.0000010	0.0000016	0.000048	0.000077
80	0.0000018	0.0000001	0.000086	0.000005
120	0.0000014	0.0000007	0.000067	0.000034
160	0.0000016	0.0000010	0.000077	0.000048

Energy of the system at requested steps (S)

S	$\langle VX,2 \rangle$	$\langle VY,2 \rangle$	$\langle KE \rangle = T^*$	$\langle U \rangle$	$\langle E \rangle = \text{Total Energy}$
0	0.0173874	0.0142851	0.760140	-4.7502660	-1.61499
2	0.0162506	0.0131025	0.704474	-4.6666675	-1.62886
4	0.0124966	0.0089562	0.514867	-4.2873015	-1.62878
6	0.0077405	0.0039113	0.279643	-3.8053113	-1.62301
12	0.0118740	0.0120959	0.575278	-4.4081878	-1.62882
18	0.0099579	0.0075854	0.421039	-4.0940627	-1.62599
24	0.0108577	0.0116978	0.541332	-4.3385782	-1.62796
30	0.0126065	0.0100340	0.543372	-4.3407997	-1.62703
50	0.0127138	0.0103334	0.553133	-4.3613165	-1.62753
70	0.0088657	0.0158292	0.592678	-4.4388669	-1.62676
90	0.0107740	0.0076446	0.442087	-4.1357699	-1.62580
130	0.0073008	0.0177446	0.601090	-4.4564333	-1.62713
180	0.0097161	0.0096426	0.464609	-4.1773882	-1.62409

All values are in reduced units. $\langle KE \rangle$ is the mean kinetic energy per atom. $\langle U^* \rangle$ is twice the potential energy. $\langle VX,2 \rangle$ and $\langle VY,2 \rangle$ are the mean values of the squares of the X and Y velocity components, as described in the question. Similarly $\langle VX,1 \rangle$ and $\langle VY,1 \rangle$ are the mean values of the velocity components. $\langle PX \rangle$ and $\langle PY \rangle$ are the mean momentum per particle.

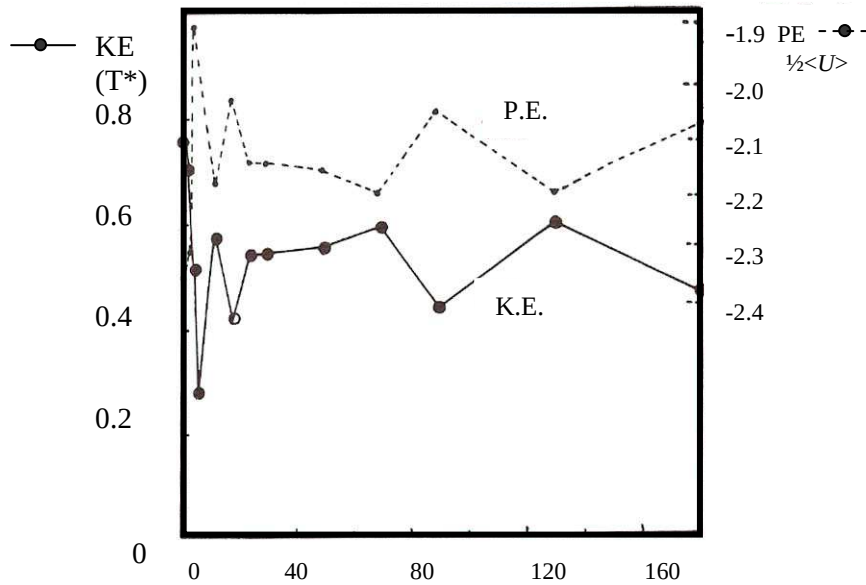
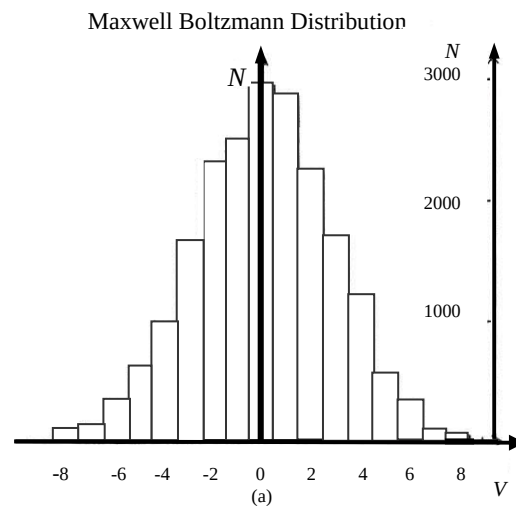
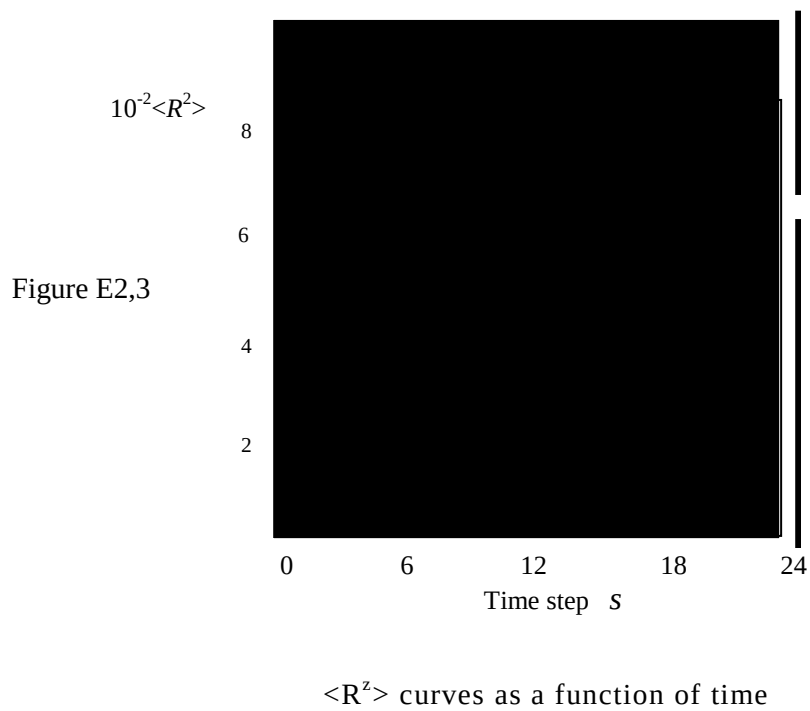
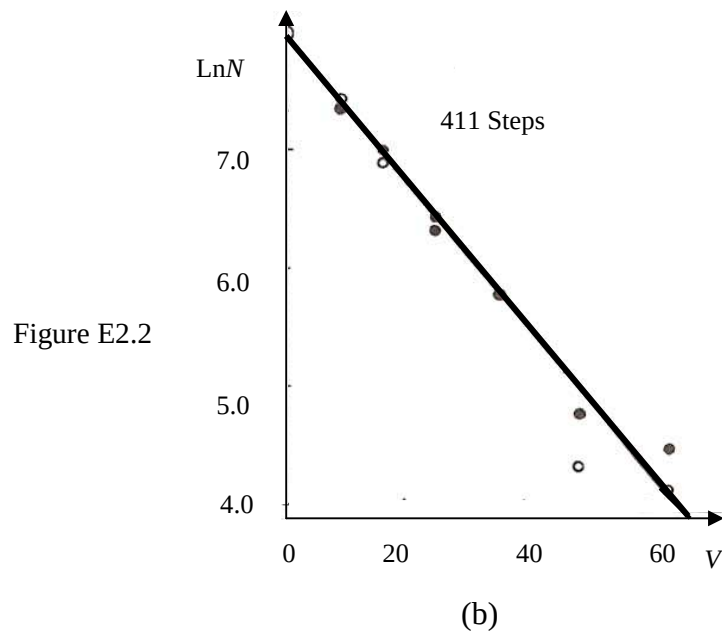


Figure E 2.1

Variation of K.E and P.E.





TYPICAL RESULTS : NOTE THE LARGE VARIATIONS IN THE VALUES OF $\langle R^2 \rangle$

Time Number SZ - S-SR	SR = 261 <R ² >	SR = 301 <R ² >	SR = 334 <R ² >	SR = 370 <R ² >	AVERAGE <R ² >
0	0	0	0	0	0
2	0.00088	0.00067	0.00091	0.00079	0.00081
4	0.00287	0.00276	0.00382	0.00298	0.00311
6	0.00523	0.00628	0.00858	0.00623	0.00658
8	0.00797	0.01101	0.01449	0.01039	0.01097
10	0.01143	0.01656	0.02095	0.01523	0.01604
12	0.01528	0.02235	0.02768	0.02022	0.02138
14	0.01874	0.02845	0.03453	0.02564	0.02684
16	0.02184	0.03539	0.04157	0.03160	0.03260
18	0.02526	0.04293	0.04902	0.03833	0.03889
20	0.02979	0.05080	0.05718	0.04532	0.04577
22	0.03538	0.05918	0.06605	0.0510	0.05303
24	0.04063	0.06784	0.07533	0.05569	0.05987