

Question 1

Question 1: Total energy of glider on a horizontal air track attached to a spring

(a)

glider's mass $m \pm 0.001$ (kg)		spring constant $k \pm 0.01$ (N/m)	
m	0.230	k	1.06
glider's velocity $v \pm 0.02$ (m/s)		extension of spring $x \pm 0.005$ (m)	
v	0.88	x	0.551

Calculations of total energy E		
Total Energy	0.24996453	J

(b)

glider's mass $m \pm 0.001$ (kg)		spring constant $k \pm 0.01$ (N/m)	
m	0.230	k	1.06
glider's velocity $v \pm 0.02$ (m/s)		extension of spring $X \pm 0.002$ (m)	
v	0.00	x	0.698

Calculations of total energy E		
Total Energy	0.25821812	J

Question 2

Question 2: Estimation of spring constant and its associated uncertainty

(a)

Data		
	Mass <i>M</i> (kg)	Period <i>T</i> (s)
#1	0.513	1.24
#2	0.581	1.33
#3	0.634	1.36
#4	0.691	1.45
#5	0.752	1.50
#6	0.834	1.59
#7	0.901	1.65
#8	0.950	1.69

Calculation		
	<i>M</i> (kg)	<i>T</i> (s)
Mean	0.732	1.47625
Std. deviation	0.1553502954	0.1607071427
Std. error	0.0549246237	0.0568185552

Answer		
Spring constant	13.2602281533	N/m
Uncertainty	1.4254274126	N/m

Question 3

Question 3: Calculation of density of cylinder

Data			
	Mass M (g)	Length L (cm)	Diameter d (cm)
#1	20.6	2.68	1.07
#2	20.5	2.67	1.05
#3	20.6	2.65	1.06
#4	20.4	2.69	1.05
#5	20.3	2.67	1.04

Calculation			
	M (g)	L (cm)	d (cm)
Mean	20.48	2.672	1.054
Std. deviation	0.1303840481	0.014832397	0.0114017543
Std. error	0.0583095189	0.0066332496	0.0050990195

Answer		
Density	8.7846081792	g/cm ³
Uncertainty	0.0912439177	g/cm ³

Question 4: Velocity of a glider on a horizontal air track

	x_i Time t (s)	y_i Position s (cm)	y_{best}
#1	-4	13	13.4
#2	-2	25	23.7
#3	0	34	34
#4	2	42	44.3
#5	4	56	54.6

LINEST()			
m	5.15	34	c
σ_m	0.2753785274	0.7788880964	σ_c
r^2	0.9914953271	1.7416467303	σ_y
	349.7472527473	3	
	1060.9	9.1	

Best estimated (s_0)	34	cm
Uncertainty (δs_0)	0.7788880964	cm
Best estimated (v)	5.15	cm/s
Uncertainty (δv)	0.2753785274	cm/s
Uncertainty (δs)	1.7416467303	cm

Question 5: Atomic absorption spectrophotometry

(a)

	x_i Mercury concentration (parts per billion)	y_i Absorption (arbitrary units)	y_{best}
#1	0.5	10	11.0975609756
#2	1.0	22	20.0670731707
#3	2.0	38	38.006097561
#4	3.0	54	55.9451219512
#5	4.0	75	73.8841463415

LINEST()			
m	17.9390243902	2.1280487805	c
σ_m	0.6366040554	1.5658389369	σ_c
r^2	0.9962362156	1.8229565907	σ_y
	794.0700917431	3	
	2638.8304878049	9.9695121951	

(b) Please see next page

(c)

Data		
Absorption	32	arbitrary units
Uncertainty	3	arbitrary units
Calculation		
A-c	29.8719512195	
Uncertainty	3.3840584476	
Answer		
Concentration of mercury	1.6651937458	parts per billion
Uncertainty	0.1976812614	parts per billion

5b)

