

Summary on data manipulation Physics 535

Accuracy of instruments

-The accuracy of an instrument depends on the number of decimal places of the small division e.g the smallest division of an ammeter is 0.02A and that means the accuracy of an ammeter is 2dps

Examples

1.

$X(m)$	$\frac{1}{x}(m^{-1})$
0.20	5.0
0.30	3.3
0.40	2.5
0.50	2.0
0.60(largest)	1.7

$$\frac{1(float)}{0.60(2sf)} = 5.0(2sf), \text{ and 1 d.p so the rest of the values to 1 d.p}$$

2.

$y(cm)$	$\frac{1}{y}(cm^{-1})$
2.5	0.4000
5.0	0.2000
7.5	0.1300
10.0	0.1000
12.5(largest)	0.0800

$$\frac{1(float)}{12.5(3sf)} = 0.0800(3sf), \text{ so the rest of the values in the to 4 d.p}$$

3.

$t(s)$	$T(s)$	$T^2(s^2)$	$\frac{1}{T}(s^{-1})$
14.0	0.70	0.49	1.429
16.5	0.83	0.68	1.205
18.0	0.90	0.81	1.111
19.5	0.98	0.95	1.020
21.0	1.05	1.10	0.952

24.5(largest)	1.23	1.50	0.813
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t=time for 20oscillations

$$T = \frac{24.5(3sf)}{20(float)} = 1.23(3sf), 2 d.p \text{ for all values in the column}$$

largest product $T^2 = 1.23(3sf) \times 1.23(3sf) = 1.53(3sf), 2 d.p \text{ for the rest of the values}$

$$\frac{1}{T} = \frac{1(float)}{1.23(3sf)} = 0.813(3sf), 3d.p \text{ for the rest of the values}$$

4.

t(s)	T(s)	$T^2(s^2)$	$\frac{1}{T}(s^{-1})$
9.5	0.48	0.23	2.083
12.5	0.63	0.40	1.587
15.0	0.75	0.56	1.333
19.5	0.98	0.96	1.020
21.0	1.05	1.10	0.953
24.5(largest)	1.23	1.51	0.813

t=time for 20oscillations

$$T = \frac{24.5(3sf)}{20(float)} = 1.23(3sf), 2 d.p \text{ for all values in the column}$$

Largest product $T^2 = 1.23(2sf) \times 1.23(3sf) = 1.51(3sf), 2 d.p \text{ for the rest of the values}$

$$\frac{1}{T} = \frac{1(float)}{1.23(3sf)} = 0.813(3sf), 3d.p \text{ for the rest of the values}$$

5.

u(cm)	v(cm)	$\frac{v}{u}$	uv(cm ²)
30.4	9.5	0.31	289
28.6	11.3	0.40	323
25.1	14.4	0.57	361
22.7	15.5	0.68	352
20.6	17.3	0.84	356
17.2	18.4	1.07	316

t=time for 20oscillations

largest quotient of $\frac{v}{u} = \frac{18.4(3sf)}{17.2(3sf)} = 1.07(3 sf)$, 2 d. p for the rest of the values

*largest product of $uv = 17.2(3sf) \times 18.4(3sf) = 316(3sf)$,
0 d.p for the rest of the values*

6.

y(cm)	d(cm)	y ² (cm ²)	d ² (cm ²)	(y ² -d ²)(cm ²)
90.0	51.8	8100	2683	5417
85.0	48.6	7225	2362	4863
80.0	43.4	6400	1884	4516
75.0	39.1	5625	1529	4096
70.0	34.4	4900	1183	3717
65.0	30.0	4225	900	3325

Largest product of $y^2=90.0(3sf) \times 90.0(3sf)=8100(4sf)$,

do not split the whole number, round off to whole number. 0 d.p for the rest of the values

Largest product of $d^2=51.8(3sf) \times 51.8(3sf)=2683(4sf)$, or 2680(3s.f)

do not split the whole number, round off to whole number. 0 d.p for the rest of the values
 $(y^2-d^2)=8100(0dp)-2683(0dp)=5417(0dp)$