B1

35.98 ± 0.11 m/s

$(1.0221 \pm 0.0006) \times 10^{-15}$ kg

0.00 ± 0.19 A

You don't have enough information to give the result for 1235 AU ± 211 km since 211 km = 1.41×10^{-9} AU.

B.2

I used python:

```
'''
Computes mean, median and mode of data in ProbB2.txt
'''

import numpy as np
import statistics as stat

time = np.loadtxt('ProbB2.txt',unpack=True)
print(time)

t_mean = stat.mean(time)
t_median = stat.median(time)
t_mode = stat.mode(time)

print('mean = %g\nmedian = %g\nmode = %g' % (t_mean,t_median,t_mode))
```

The output is:

```
In [10]: run ProbB2.py
[ 15.5  15.2  15.6  15.7  14.9  14.7  14.6  15.4  15.4  14.8  14.9
15.1
  14.2  14.5  14.8  14.9  15.6  14.1  15.7  14.7]
mean = 15.015
median = 14.9
mode = 14.9

In [11]:
```

B.3 (a) Again use python:

```
Computes mean, median and mode of data in ProbB2.txt
'''

import numpy as np
import statistics as stat

# For part (a)
time = np.loadtxt('ProbB2.txt',unpack=True)
print(time)

t_mean = stat.mean(time)
N = len(time)
s = np.sum((time-t_mean)**2)/(N-1)
sdom = s/np.sqrt(N)

print('mean = %g, sample std dev = %g, sdom = %g' % (t_mean,s,sdom))

# For part (b), use sdom for uncertainty

print('%g ± %g' % (t_mean,sdom))
```

```
In [12]: run ProbB3.py
[ 15.5  15.2  15.6  15.7  14.9  14.7  14.6  15.4  15.4  14.8  14.9  15.1
  14.2  14.5  14.8  14.9  15.6  14.1  15.7  14.7]
mean = 15.015, sample std dev = 0.235026, sdom = 0.0525535
15.015 ± 0.0525535

In [13]:
```

For part (b) the proper way to write the result is

15.015 ± 0.053 days

B. 5

$$\bar{n} = \sum_{n=1}^{\infty} n \frac{\nu^n}{n!} e^{-\nu}$$

$$= \sum_{n=1}^{\infty} \frac{\nu^n}{(n-1)!} e^{-\nu}$$

$$= e^{-\nu} \nu \sum_{n=1}^{\infty} \frac{\nu^{(n-1)}}{(n-1)!}$$

Let $m = n - 1$ then

$$\bar{n} = e^{-\nu} \nu \underbrace{\sum_{m=0}^{\infty} \frac{\nu^m}{m!}}_{e^{\nu}}$$

$$\bar{n} = \cancel{e^{-\nu}} \nu \cancel{e^{\nu}}$$

$$\boxed{\bar{n} = \nu \qquad \text{QED}}$$

B.7 The count rate $r \approx 100\,s^{-1}$

For a 1% measurement,

$$\frac{\delta n}{n} = 0.01 \quad \text{or}$$

$$\frac{n}{\delta n} = 100$$

But, $\frac{n}{\delta n} = \sqrt{n}$ so $\sqrt{n} = 100 \Rightarrow n = 10^4$

$$n = rt \Longrightarrow t = \frac{n}{r} = \frac{10^4}{100\,s^{-1}}$$

$$\boxed{t = 100\,s}$$

B.9 The perimeter $p = 2\ell + 2w$, where ℓ is the length and w is the width of the table. Using Eq. B.27

$$\delta p = \sqrt{\left(\frac{\partial p}{\partial \ell}\delta\ell\right)^2 + \left(\frac{\partial p}{\partial w}\delta w\right)^2}$$

$$\frac{\partial p}{\partial \ell} = 2, \quad \frac{\partial p}{\partial w} = 2$$

$$\delta p = 2\sqrt{\delta\ell^2 + \delta w^2}$$

$\delta\ell = 0.2\text{ cm}$ and $\delta\ell = 0.6\text{ cm}$

$$\delta p = 2\sqrt{(0.2)^2 + (0.6)^2}\text{ cm}$$

$$\boxed{\delta p = 1.3\text{ cm}}$$