Estimate the magnitude of the error involved in using the sum of the first four terms to approximate the sum of the entire series.

11. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{n}$ It can be shown that the sum is $\ln 2$.

actual sum $= \ln 2$

partial sum $S_4 = \frac{7}{12} = .58\overline{33}$

error: $\left| \ln 2 - \frac{7}{12} \right| = \boxed{0.1098}$

$*$note $a_5 = \frac{1}{5} = 0.2$

12. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{10^n} = \frac{1}{10} - \frac{1}{100} + \frac{1}{1000} - \frac{1}{10000} + \ldots + (-1)^{n+1}\cdot\frac{1}{10^n}$

Actual sum $= \frac{a}{1-r} = \frac{\frac{1}{10}}{1 - -1/10} = \frac{\frac{1}{10}}{11/10} = \frac{10}{11\cdot 10} = \frac{1}{11}$

partial sum $S_4 = 0.0909$

error $= \left| \frac{1}{11} - .0909 \right| = .00000909$
$= \boxed{9.09 \times 10^{-6}}$

$*$ note: $a_5 = .00001$
$= 1 \times 10^{-5}$

13. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{(0.01)^n}{n}$ The sum is $\ln(1.01)$

Actual sum $= \ln(1.01)$

partial sum $S_4 = .00995$

error: $\left| \ln(1.01) - 0.00995 \right| = \boxed{1.98 \times 10^{-11}}$

$*$note: $a_5 = 2 \times 10^{-11}$