

**Exam 1 Cover Sheet**  
**Physics 3, Feb 26, 2019**

Some direction:

No phones or other device that connects to the internet.

You may use a calculator, and I would prefer you to plug in numerical answers and keep three sig figs regardless of the correct number of sig figs in the problem.

**Present clear and complete answers:**

Explain your answers clearly but briefly. You want to aim for a level of solution that someone taking this class would be able to understand. A diagram and a few words may help.

Start calculations with first principles: things like definitions ( $\vec{E} \equiv \frac{\vec{F}}{Q}$ ) or empirical laws (like Coulomb's Law or Newton's Laws) or conservation laws.

**Check time:**

The point values for each problem are shown next to the question number. Time yourself accordingly. The total value of the exam is 100 points. **Good luck!**

**Some constants:**

$$K = k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 Nm^2/C^2 \approx 9 \times 10^9 Nm^2/C^2$$
$$\epsilon_0 = 8.85 \times 10^{-12} C/N/m^2$$
$$e = 1.6 \times 10^{-19} C$$

**Helpful Equations:**

$$F = |\vec{F}| = k \frac{|qQ|}{r^2} \quad \vec{F} = k \frac{qQ}{r^2} \hat{r}$$

$$\vec{E} \equiv \frac{\vec{F}}{Q}$$

$$E = |\vec{E}| = k \frac{|q|}{r^2} \quad \vec{E} = k \frac{q}{r^2} \hat{r}$$

$$dq = \lambda d\ell$$

$$dq = \sigma da = \eta da$$

$$dq = \rho dV$$