

Physics 235 Fall 2013: Final Exam Form #1

**You must enter your form number on
your scantron key field to receive your score.**

Please Print Your Name: _____

Instructions

1. Fill in your name above
2. Fill in your **name**, **ID number**, and **form number** on your scantron sheet
3. This will be a two-hour (120 minute), closed book exam.
4. You may use a calculator, please do not share calculators.
5. The exam includes 25 multiple choice questions which will be machine graded. Each question is worth 4 points. No partial credit will be given.
6. For this exam, you can bring *four* 3×5" index cards or one 8½×11" sheet of paper with any notes you wish to have. You may use a ruler if you wish. You will also find all the physical constants that you might require listed below.
7. **Please take your exam booklet with you and keep it safe and unaltered.**

Constants you might need:

$$k = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$$

$$g = 9.8 \text{ m/s}^2$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

$$\text{Mass of the electron: } 9.11 \times 10^{-31} \text{ kg}$$

$$\text{Magnitude of the electron charge: } 1.6 \times 10^{-19} \text{ C}$$

$$\text{Mass of the proton: } 1.67 \times 10^{-27} \text{ kg}$$

$$\text{Atomic Mass Unit (1 AMU): } 1.66 \times 10^{-27} \text{ kg}$$

$$1 \text{ Gauss} = 10^{-4} \text{ T}$$

$$\text{Speed of sound in air} = 340 \text{ m/s}$$

$$\text{Threshold of hearing } I_0 = 10^{-12} \text{ W/m}^2$$

$$\text{Speed of light in vacuum} = 3.0 \times 10^8 \text{ m/s}$$

$$k_B = 1.38 \times 10^{-23} \text{ m}^2\text{kg/s}^2\text{K} = 1.38 \times 10^{-23} \text{ J/K}$$

$$\sigma = 5.7 \times 10^{-8} \text{ W/m}^2\text{K}^4$$

$$0 \text{ }^\circ\text{C} = 273.15 \text{ K}$$

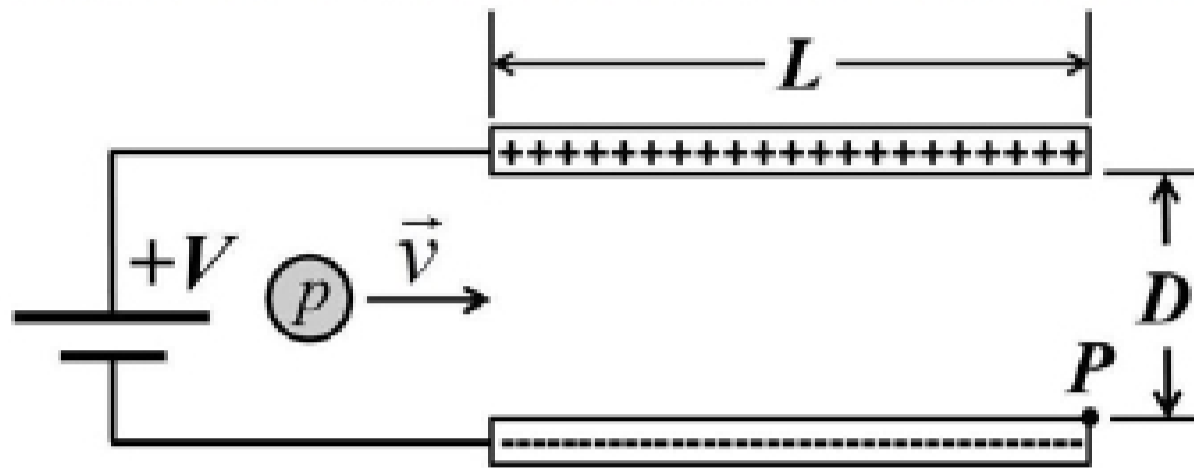
$$1 \text{ electron volt (1eV)} = 1.6 \times 10^{-19} \text{ J}$$

$$\text{Astronomical Unit (1AU)} = 1.5 \times 10^{11} \text{ m}$$

$$1 \text{ Light Year} = 9.47 \times 10^{15} \text{ m}$$

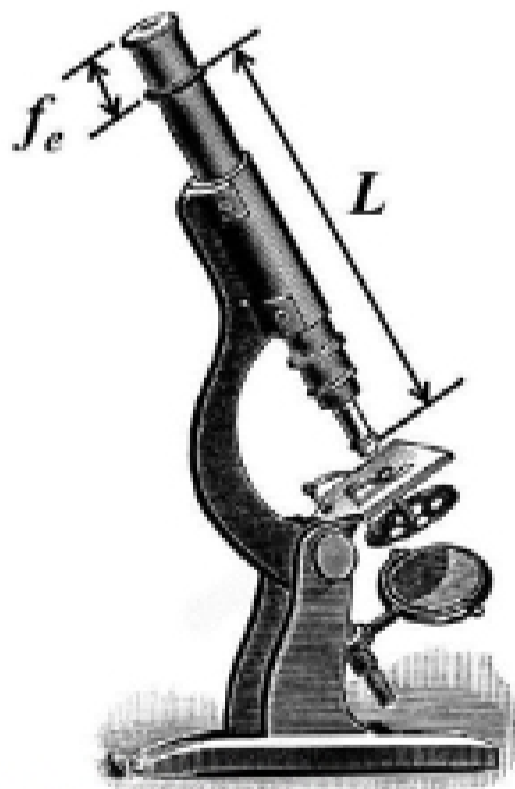
$$1 \text{ Parsec} = 3.3 \text{ Light Years}$$

1. A proton moving with a horizontal velocity \vec{v} , with a speed equal to 1% of the speed of light, enters the region *midway* between two large parallel plates which are separated by a distance $D = 2.00$ cm. The plates have a length $L = 10.00$ cm. What potential V must be applied across the plates to deflect the path of the proton so that it just misses the corner of the bottom plate at point P ? You may neglect gravity.



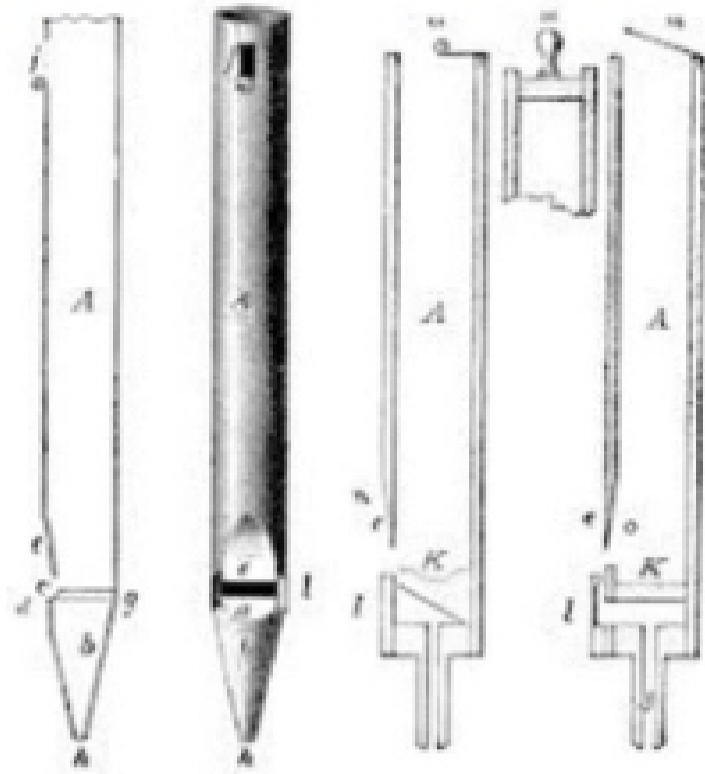
This Drawing is Not to Scale!

- A) 2810V
 - B) 3758V
 - C) 4332V
 - D) 5150V
 - E) 6712V
2. For the compound microscope shown, the length $L = 24.0$ cm and the focal length of the eyepiece is $f_e = 2.0$ cm. If the focal length of the objective lens is $f_o = 4.0$ mm, what is the total angular magnification M of the microscope? You may assume the object to be viewed is just beyond the focal length of the objective lens.



- A) $M = -250$
- B) $M = -500$
- C) $M = -750$
- D) $M = -1000$
- E) $M = -1250$

3. Given that the ends of an organ pipe can be either closed-open or open-open, what is the *shortest* pipe that can produce a fundamental frequency of 32 Hz?



- A) 13.3 m
- B) 8.0 m
- C) 10.6 m
- D) 2.7 m
- E) 5.3 m

4. You are observing two stars through a telescope. The angular separation of the two stars on the sky is 2.0×10^{-3} radians. The angular separation of the two stars viewed through the telescope is 10^{-1} radians. If the telescope eyepiece has a focal length of $f_e = 1.5$ cm, what is the total length L of the telescope?



- A) $L = 74.5$ cm
- B) $L = 75.0$ cm
- C) $L = 75.5$ cm
- D) $L = 76.0$ cm
- E) $L = 76.5$ cm