Student ID Number: ________

PRELIMINARY EXAMINATION

Department of Physics
University of Florida
Part D, January, 2017, 14:00–17:00

Instructions

1. You may use a calculator and CRC Math tables or equivalent. No other tables or aids are allowed or required. You may **NOT** use programmable calculators to store formulae.
   (a) All of the problems will be graded and will be tabulated to generate a final score. Therefore, you should submit work for all of the problems.
   (b) For convenience in grading please write legibly, use only one side of each sheet of paper, and work different problems on separate sheets of paper. The sheets for each problem will be stapled together but separately from the other two problems.
   (c) Your assigned student **ID Number**, the **Problem Number**, and the **Page Number** should appear in the upper right hand corner of each sheet. Do **NOT** use your name anywhere on the Exam.
   (d) All work must be shown to receive full credit. Work must be clear and unambiguous. Be sure that you hand your completed work to the Proctor.
   (e) Each problem is worth 10 points.
   (f) Following the UF Honor Code, your work on this examination must reflect your own independent effort, and you must not have given, nor received, any unauthorized help or assistance. If you have any questions, ask the Proctor.

University of Florida Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

DO NOT OPEN EXAM UNTIL INSTRUCTED

PRELIMINARY EXAMINATION

DEPARTMENT OF PHYSICS

UNIVERSITY OF FLORIDA

Part D, January, 2017, 14:00–17:00

D1. **(Hirschfeld)** The total radiant energy flux density at the earth from the sun is called the Solar constant and has a value 1.36kW/m^2. To solve the following problems, you will need the following numbers:

Earth-Sun distance $1.5 \times 10^{11}\,\text{m}$
Radius of the Sun $7 \times 10^{8}\,\text{m}$
Radius of Earth $6.37 \times 10^{6}\,\text{m}$
Stefan-Boltzman constant $5.67 \times 10^{-8}\,\text{W/m}^2\text{K}^4$

(a) [**2 points**] Calculate the total rate of energy generation of the Sun.

(b) [**2 points**] Calculate the effective temperature of the surface of the Sun.

(c) [**3 points**] Calculate the Earth's surface temperature on the assumption that a black body in equilibrium re-radiates as much thermal radiation as it receives from the Sun.

(d) [**3 points**] The answer for part (c) above is reasonably close to the Earth's temperature. Show, following the same ideas, that the relationship between the planetary temperature (for any planet in the solar system) T_p and the planetary distance from the Sun R_p is $T_p\sqrt{R_p} =$ constant. Derive that constant.

PRELIMINARY EXAMINATION
Department of Physics
University of Florida
Part D, January, 2017, 14:00–17:00

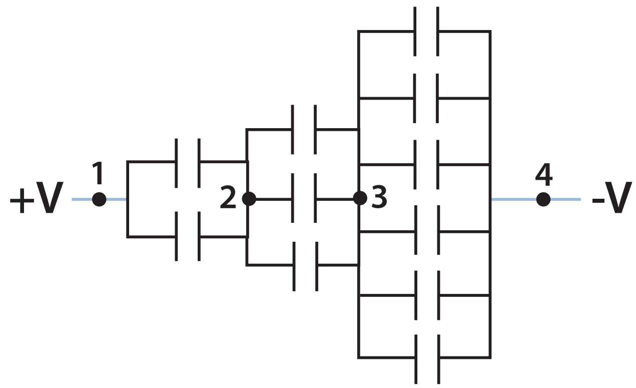
D2. **(Ray)** A 60 W lightbulb produces only 3 W of visible light, the rest is produced in the infrared (*i.e.*, heat). The peak wavelength in the visible spectrum is 550 nm.

(a) [**points**] How many visible photons does the bulb produce each second?

(b) [**points**] If you are standing 3 meters away from the bulb, how many visible photons will enter your eye per second? Assume the diameter of your pupil is 1 mm.

PRELIMINARY EXAMINATION
Department of Physics
University of Florida
Part D, January, 2017, 14:00–17:00

D3. **(Stewart)**



(a) [**3 points**] Assume all the capacitors in the picture are equal with a value = C. What is the net capacitance of the arrangement of capacitors between the two battery terminals (*i.e.,* between points 1 and 4), in terms of C?

(b) [**2 points**] When the battery voltage V is connected to this bank of capacitors, how much total energy is stored in all the capacitors together?

(c) [**3 points**] What fraction of the voltage V appears between the positive +V terminal and the junction between the first two capacitors and the next three capacitors, *i.e.,* between points 1 and 2?

(d) [**2 points**] How much energy is stored in the leftmost two capacitors between points 1 and 2?