PHYSICS DEPARTMENT

PHY 2054 2nd Practice Exam October 19, 2000

Sec.#_____

Name (print, last first): _____ Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

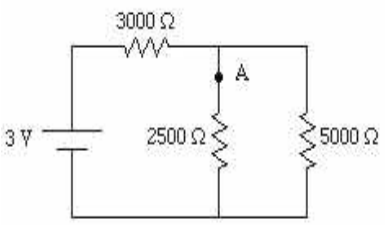
DIRECTIONS

(1) **Code your test number on your green answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. Darken circles completely (errors can occur if too light). Code your student number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work on this exam to the right of the questions, and anywhere else on this exam that you like. At the end of the test, this exam printout is to be turned in. No credit will be given without both the answer sheet and printout, with the scratch work which most questions demand of anyone.
(4) Remember you are allowed **two** wrong answers without penalty (*two free guesses*). Guessing is not recommended, however, since you will receive −0.25 points for each incorrect answer beyond two. You will receive one point for each correct answer and zero points for no answer.
(5) Black the circle of your intended answer completely, using a number 2 pencil on the answer sheet. Do not make any stray marks or the answer sheet may not read properly.
(6) As an aid to the examiner (and yourself) in the case of poorly marked answer sheets, please circle your selected answer on the examination sheet.
(7) Good luck!!!! Have fun!!!

>>>>>>>>**BEFORE YOU FINISH** <<<<<<<<

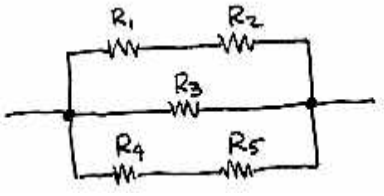
Fold the computer printout so your name is on top, include any figure sheet inside the printout. Hand in the green answer sheet separately.

1. You are given the circuit in the figure. An ammeter with resistance 250- is now inserted at point A in the circuit. How does the current through the 5000- resistor change from its previous value? Select the closest answer. Note $1\mu\text{A} = 10^{-6}$ A.



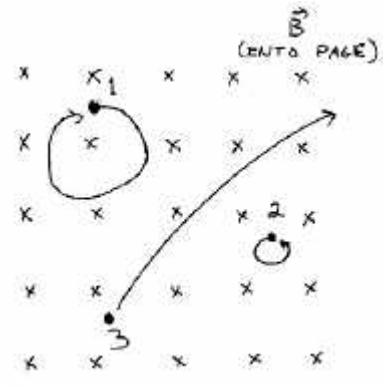
(1) It decreases by 25 μA.
(2) It increases by 25 μA.
(3) It increases by 50 μA.
(4) It does not change.
(5) It decreases by 50 μA.

2. You are given the resistor network shown in the figure. Find the equivalent resistance (in -) for this network. $R_1 = 100$- , $R_2 = 200$- , $R_3 = 275$- , $R_4 = 50$- , $R_5 = 250$- , and $R_6 = 250$- . (Select the closest answer.)



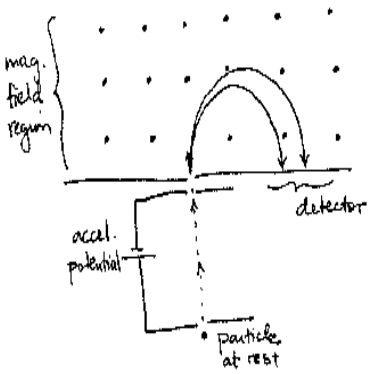
(1) 110 (2) 80 (3) 130 (4) 95 (5) 65

3. Three particles of equal masses and charge magnitudes follow the paths in the B field shown in the figure. The B field is directed into the paper. Which of the following statements are **correct**?



(1) Particle 2 is negatively charged and has the smallest velocity.
(2) Particle 1 is negatively charged and has the smallest velocity.
(3) Particle 3 is positively charged and has the greatest velocity.
(4) Particle 1 is negatively charged and has the greatest velocity.
(5) Particle 3 is negatively charged and has the greatest velocity.

4. Two charged particles are injected into a mass spectrometer. They have identical mass 1×10^{-27}kg, but different charge ($+e$ and $+2e$, where e is the electronic charge). Both are accelerated by an electric potential difference of 10 kV, and injected into the magnetic field region of a mass spectrometer whose field strength is 12 tesla. How far apart will the two particles be (in m) when they strike the detector (i.e., after their trajectories pass through a full semicircle)? (Select the closest answer.)

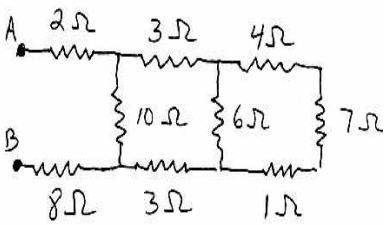


(1) 1×10^{-4}
(2) 1×10^{-3}
(3) 1×10^{-2}
(4) 5×10^{-4}
(5) 5×10^{-3}

5. An electron is accelerated from rest by a 10000 V potential. It then enters a B field (oriented perpendicular to the velocity of the electron) such that the electron makes a circular orbit of radius 0.25 mm. What is the magnitude of the B field (in T)?

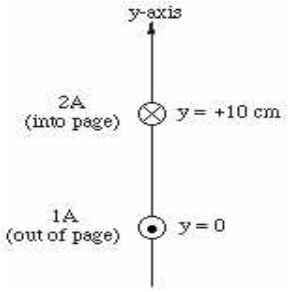
(1) 0.95 (2) 0.95×10^{-3} (3) 1.35 (4) 0.62 (5) 1.35×10^{-3}

6. If the resistor network in the figure is connected to a 30 V battery, determine the power (in W) dissipated in the 2-- resistor.



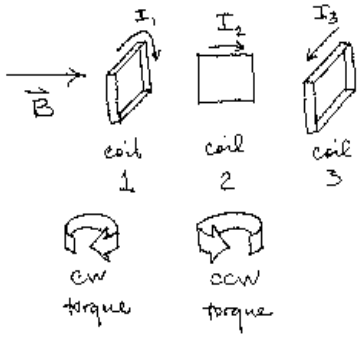
(1) 1.0 (2) 3.3 (3) 2.9 (4) 1.5 (5) 8.0

7. The figure shows two parallel current-carrying wires which are oriented perpendicular to the page. On the indicated y-axis running through the two wires, at what position (in m) does the magnetic field equal to zero?



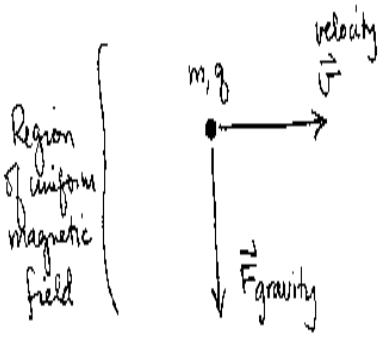
(1) -0.24
(2) 0.033
(3) -0.05
(4) -0.1
(5) 0.041

8. Three current-carrying loops are placed in a magnetic field as shown. What is the direction of the torque on the three loops? Let CW = clockwise, CCW = counterclockwise (see figure for explanation of directions).



(1) CW; no torque; CCW
(2) CCW; no torque; CW
(3) No torque; CCW; no torque
(4) No torque; no torque; no torque
(5) No torque; CW; no torque

9. A massive particle with charge $+1 \times 10^{-15}$C moves with velocity 2×10^8m/sec through a region of uniform magnetic field strength 50 tesla (see Figure). Gravity also acts on the particle in the indicated direction. What direction must the magnetic field have; and what is the mass (in kg) of the particle if it moves with constant velocity and direction through this region? (Select the closest answer.)



(1) field directed to top of page; 10^{-6}
(2) field directed into the page; 10^{-4}
(3) field directed into the page; 10^{-6}
(4) field directed out of the page; 10^{-6}
(5) field directed out of the page; 10^{-4}

10. Which of the following statements is **incorrect**?

(1) The magnetic force vector on a moving charge is unchanged if both the velocity and magnetic field directions are reversed.
(2) A charged particle moving at a 45° angle with respect to a uniform magnetic field has a helical trajectory.
(3) The direction of the magnetic force on a charged particle depends on the sign of the charge, but the magnitude of the force does not.
(4) If a charged particle experiences no magnetic force as it moves through a region of space, then the magnetic field in that region must be zero.
(5) The direction of the magnetic force on a current-carrying wire depends on the current direction, but the magnitude of the force does not.

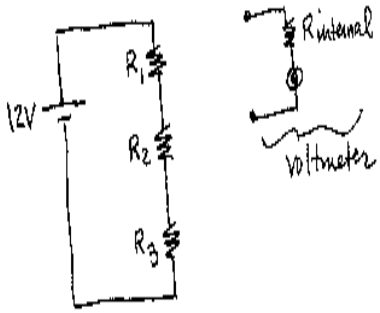
11. Which of the following statements is **false**?

(1) The speed of a particle moving in a magnetic field is always constant.
(2) Charged particles moving in a magnetic field always have circular trajectories.
(3) No force acts upon a charged particle moving parallel to the magnetic field direction.
(4) Like magnetic poles repel, unlike magnetic poles attract.
(5) The magnetic force cannot alter the kinetic energy of a moving charged particle.

12. Which of the following statements is **incorrect**?

(1) A uniform magnetic field cannot do work on a charged particle.
(2) A uniform electric field cannot do work on a charged particle.
(3) An ideal ammeter has zero resistance.
(4) When any two circuit elements are placed in parallel their voltages must be the same.
(5) A current cannot flow through a capacitor forever.

13. A voltmeter with internal resistance 20 k- is attached across resistor R_1 in Figure 9. $R_1 = 8k$- . $R_2 = 5k$- , and $R_3 = 5k$- . What voltage (in V) does it measure? (Select the closest answer.)

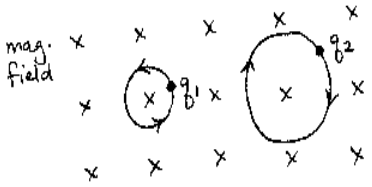


(1) 5.0 (2) 4.4 (3) 4.8 (4) 3.2 (5) 3.8

14. (A) Two identical resistors are connected first in parallel, and then in series. (B) Two identical capacitors are connected first in parallel, and then in series. Which of the following statements is **true**?

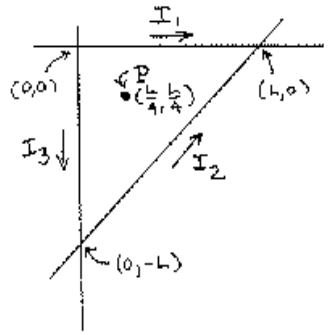
(1) (A) The series combination has the higher resistance; (B) the parallel combination has the higher capacitance.
(2) (A) The parallel combination has the higher resistance; (B) the series combination has the higher capacitance.
(3) None of the other statements are true.
(4) (A) The series combination has the higher resistance; (B) the series combination has the higher capacitance.
(5) (A) The parallel combination has the higher resistance; (B) the parallel combination has the higher capacitance.

15. Consider a region of spatially uniform magnetic field as shown in the figure. Two charged particles have identical speed and mass, and move in circular orbits with the indicated directions. Which of the following statements is **true**?



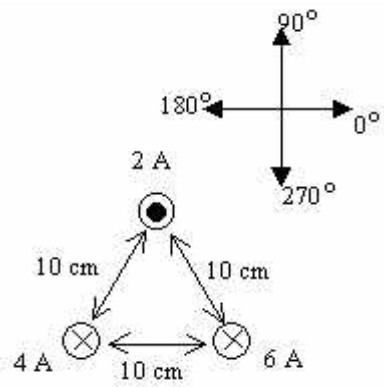
(1) $q_1 < 0$, $q_2 > 0$, and $|q_1| > |q_2|$.
(2) $q_1 > 0$, $q_2 < 0$, and $|q_1| > |q_2|$.
(3) $q_1 > 0$, $q_2 < 0$, and $|q_2| > |q_1|$.
(4) $q_1 < 0$, $q_2 > 0$, and $|q_2| > |q_1|$.
(5) No conclusion can be made regarding their relative charge.

16. Three current-carrying wires lie in a plane, as shown in Figure 2. Let $I_1 = 7.5A$, $I_2 = 3A$, $I_3 = 2A$ and $L = 6$ cm. What is the magnitude (in T) of the magnetic field at point P? Select the closest answer.



(1) 8×10^{-6}
(2) 1.5×10^{-4}
(3) 2×10^{-4}
(4) 1×10^{-4}
(5) 4.5×10^{-5}

17. Refer to the figure. Three wires carry current perpendicular to the page as shown. If wire 1 carries 2A current (out of the page), wire 2 carries 4A current (into the page), and wire 3 carries 6A current (into the page), what is the magnitude of the force per unit length (in N/m) exerted on wire 3? Assume the wires are 10 cm apart.

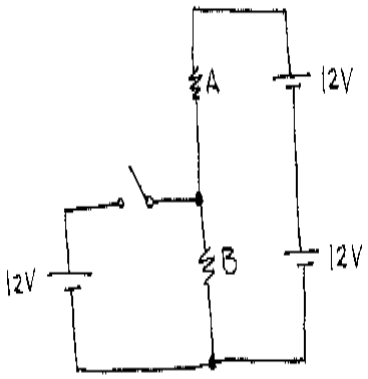


(1) 2.4×10^{-5}
(2) 4.2×10^{-5}
(3) 4.8×10^{-5}
(4) 7.2×10^{-5}
(5) 2.1×10^{-5}

18. Consider an RC circuit consisting of a series-connected battery (12V), resistor (5 k-), capacitor (10 μF), and a switch. Initially the switch is open and the capacitor is discharged. At a certain time the switch is closed. Which of the following statements are now **true**?

(1) There is zero current in the circuit because the electrons cannot flow across the gap in the capacitor.
(2) The current in the circuit decreases exponentially in time.
(3) The current in the circuit is constant in time, since the emf provided by the battery is constant.
(4) The voltage across the resistor increases exponentially in time.
(5) The current in the circuit increases exponentially in time.

19. Two identical light bulbs (drawn as resistors, labeled A and B) are connected to 12V batteries as indicated. Which of the following statements is **true** after the switch ("S") is closed?



(1) The intensity of light bulb A increases
(2) Both bulbs go out
(3) The intensity of light bulb A decreases
(4) The intensity of light bulb B increases
(5) Both bulbs remain the same brightness

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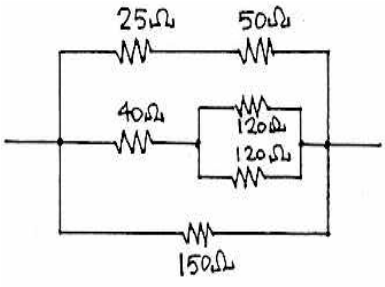
20. In the figure, the current flowing through the 40 - resistor is 0.25 A. What is the potential difference (in V) across the 50 - resistor?



(1) 10.0
(2) 15.0
(3) 16.7
(4) 12.5
(5) 28.0