PHYSICS DEPARTMENT

PHY 2054 — Exam 2 – SH Chs 18–21 — July 16, 2002

F.E. Dunnam

Name (print): ______________________ 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 answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. **Darken circles completely**. Code your student number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere 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 answer sheet and printout with scratch work most questions demand.
(4) **Blacken the circle of your intended answer completely, using a number 2 pencil**. Do not make any stray marks or the answer sheet may not read properly.
(5) Good luck!!!! Have fun!!!

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

Fold the computer printout so your name is on top. Hand in the green answer sheet separately.

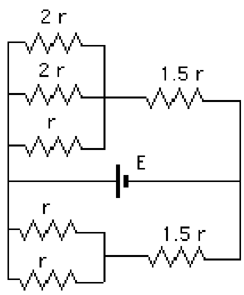
Note: Numerical answers may be "rounded off" within 1% of calculated values.

If none of the listed answers is correct, the correct answer is **no answer**.

Useful (?) Constants:

$k = 9 \times 10^9 \mathrm{Nm}^2/C^2$		$\mu_0 = 4\pi \times 10^{-7}\mathrm{Tm/A}$	
proton mass $= 1.67 \times 10^{-27}$kg		electron mass $= 9.1 \times 10^{-31}$kg	
"milli-" $= 10^{-3}$	"micro-" $= 10^{-6}$	"mega-"$=10^6$	"pico-" $= 10^{-12}$
cw = clockwise		ccw = counterclockwise	

1. In the circuit shown, the current flowing through the emf E is:

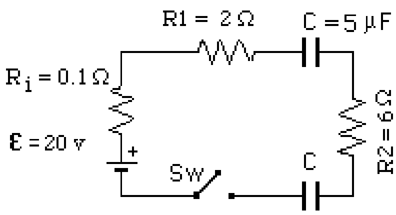


(1) E/r
(2) E/2r
(3) E/3r
(4) 2E/3r
(5) E/4r

2. Please see the figure in the previous question. The current flowing in the bottom-most resistor r is:

(1) E/4r (2) E/r (3) E/3r (4) 2E/3r (5) E/2r

3. In the circuit shown, the internal resistance of the battery is O.1 ohm and the capacitors are initially uncharged. The current (in A) flowing in the 6-ohm resistor an instant after the switch is closed is



(1) 9.5 (2) 4.9 (3) 3.9 (4) 1.8 (5) zero

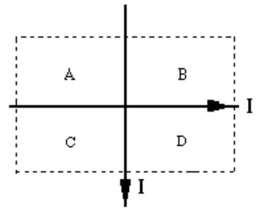
4. For the above circuit, the switch is opened after a time t = 1 time constant has elapsed. What is the charge (in microC) on the lower capacitor C?

(1) 1.6 (2) 2.5 (3) 3.9 (4) 0.8 (5) zero

5. For the above situation [switch opened after $t = 1$ time constant] what current (in A) flows through the 6-ohm resistor?

(1) zero (2) 9.5 (3) 4.9 (4) 1.8 (5) 3.9

6. In the figure shown, two conducting wires carry identical currents I in the directions shown. At any point equidistant from each wire, which quadrant area(s) [A, B, C, D] will have magnetic field(s) of greatest magnitude?

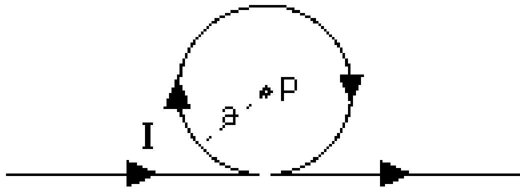


(1) B and C (2) A and D (3) A only (4) C only (5) all are the same

7. For the above situation, the currents will produce a magnetic field in quadrant C that is generally

(1) up, out of the page (2) down, into the page (3) to the left (4) to the right (5) angling downward

8. The sketch shows a long straight wire carrying a current I = 1A in the direction shown. In the middle of the wire is a circular kink of radius a = 10 cm, around which the current flows as indicated. The current produces a magnetic field (in microT) at the point P, of magnitude and direction equal to:



(1) 4.3 into page (2) 8.3 into page (3) 4.3 out of page (4) 8.3 out of page (5) none of these

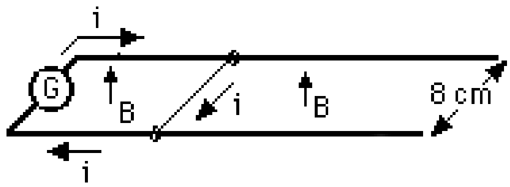
9. An electron (mass m, charge e) moving with velocity v at right angles to an applied uniform magnetic field B will travel in a circular path of radius (in m) equal to

(1) mv/eB (2) $mv/2B$ (3) me/vB (4) eB/mg (5) none of these

10. The work done per revolution (in J) by the B-field on the moving electron in the above situation is:

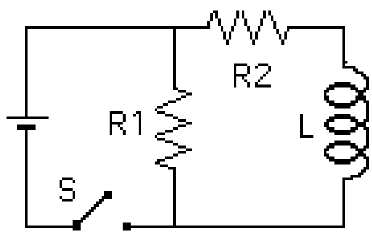
(1) zero (2) $2\pi mv^2$ (3) $\pi B/me$ (4) $mv^2/2\pi$ (5) none of these

11. The sketch shows a wire sliding along two conducting rails that are immersed in a uniform magnetic field B that is directed upward at right angles to the plane of the rails. If B = 1.0 T and the induced current flows in the direction indicated, how fast (in m/s) and in what direction must the wire move in order to generate a potential difference of 1.0 volts across meter G?



(1) 12.5, right (2) 12.5, left (3) 0.08, left (4) 0.08, right (5) none of these

12. An inductor L of negligible resistance is connected in a circuit with a 50-volt battery and resistors $R1 = 500$ ohms and $R2 = 100$ ohms as shown. What is the current (in A) immediately after the switch is closed?



(1) 0.1 (2) 0.08 (3) 5.1 (4) 0.6 (5) none of these

13. For the circuit above, the potential difference in volts across $R2$ a long time after the switch is closed will be

    (1) 50 (2) 8.33 (3) 41.7 (4) zero (5) none of these

14. For the circuit above, the energy stored in the inductor after a long time is found to be 0.8 J. What is the inductance of L, in H?

    (1) 6.4 (2) 8.0 (3) 0.4 (4) 1.6 (5) none of these

15. An ideal 5 : 1 stepdown transformer supplies 40 kW (rms) power at 240 V (rms) to a building. The transmission line (connected to the primary) has a total resistance of 1.2 ohms. The rms power loss in this line (in kW) is

    (1) 1.33 (2) 0.03 (3) 40 (4) 12 (5) insufficient data

16. The electrical output of a commercially- available 30 cm $\times$ 100 cm photovoltaic solar panel is measured to be 20 volts at 1.2 ampere and the panel's conversion efficiency is listed as 10%. Under these conditions, what is the intensity of the incident solar radiation, in W/m^2?

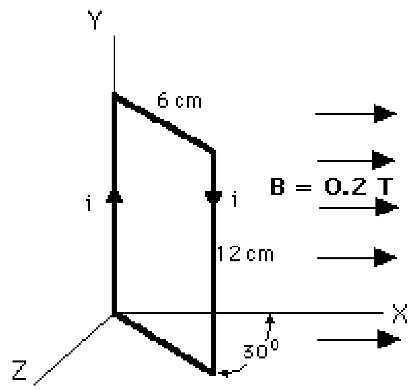
    (1) 800 (2) 1000 (3) 720 (4) 24 (5) 72

17. The magnetic component of the electromagnetic wave delivering a cellular telephone signal is measured to be 1.5 e-10 T. How much energy (in micro J) from this wave does the side of your head intercept during a 60-s call? [Assume head area = 0.04 m^2]

    (1) 6.4 (2) 2.7 (3) 160 (4) 0.01 (5) 180

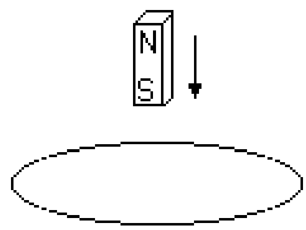
18. Choose the correct statement(s): The "120 volts ac" available at wall receptacles in most US buildings:
    A. Is the peak value of the sinusoidally varying voltage
    B. Has a peak value of about 170 volts
    C. Has an rms value of about 84 volts
    D. Would dissipate slightly more than 140 W from a 100-ohm resistor connected across it

    (1) BD (2) A only (3) B only (4) AD (5) AC



19. The sketch depicts a 50-turn rectangular loop of dimensions indicated, hinged along the Y-axis and immersed in a uniform magnetic field B = 0.2 T that points in the +X direction. The current in the loop is 4 A. The torque on the loop (in N m) and its direction of rotation, viewed from above, is

    (1) 0.25, CW
    (2) 0.25, CCW
    (3) 0.14, CW
    (4) 0.14, CCW
    (5) 0.005, CW



20. The figure shows a conducting loop, toward which a bar magnet is dropping, S-pole bottom-most. Viewed from above, as the magnet approaches and then falls away below the loop, the induced current in the loop will be, respectively,

    (1) CW, CCW (2) CCW, CW (3) CW, CW (4) CCW, CCW (5) zero

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 2 4 5 7 10 13 14