

Final Exam – Fisi 3162/3172

Name: _____

Monday, May 18, 2009

Section: _____

Prof. _____

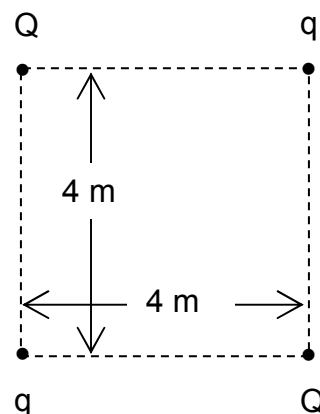
- **Read the instructions carefully.**
- **Select the best answer.**
- **You are required to answer only 20 of the 25 questions.**
- **When you finish the exam you have to select and identify the 20 questions to be corrected by writing the question's number in the square spaces provided in this page and write the answer in the square space adjacent the selected questions**
- **If you choose not to indicate which questions are the chosen ones, the first 20 questions will be the ones corrected.**
- **All answers must be justified, either by some analytical procedure or by some physics principle unless otherwise indicated in the text of the question.**
- **If there is no justification for the answer then it will be considered a wrong answer. In other words 'to guess' the answer is not valid.**
- **The points assigned will be: 5% to a correct answer with a correct justification, 2.5 % to an incorrect answer with a correct justification, and 0% to a correct or incorrect answer either with no justification or an incorrect one.**

Question # / Answer / %

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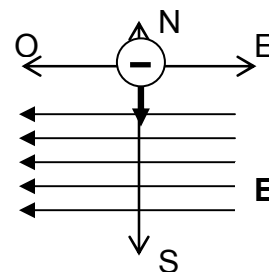
1. An electric charge Q is placed in each of the opposing corners of a square with sides equal to 4 m. An electric charge $q = -1/2 \mu\text{C}$ is placed in each of the other two corners. The numeric value of Q if the net force on it is null or zero is:

- a) $4 \mu\text{C}$
- b) $2 \mu\text{C}$
- c) $\sqrt{2} \mu\text{C}$
- d) $1/\sqrt{2} \mu\text{C}$
- e) Another: Which one?

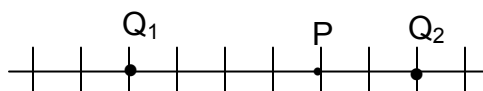


2. An electron moving SOUTH enters a region of space where there is a uniform electric field which points to the WEST. From this point on the electron: (The justification of the answer to this question is a diagram that explains what is happening.)

- a) begins to turn to the west and reduces its velocity.
- b) begins to turn to the west and increases its velocity.
- c) begins to turn to the east and reduces its velocity.
- d) begins to turn to the east and increases its velocity.
- e) continues in the same direction and with the same velocity.



3. Charges Q_1 and Q_2 are placed as shown in the figure. The net electric field at point P is zero. Which of the following statements for Q_1 and Q_2 are true?



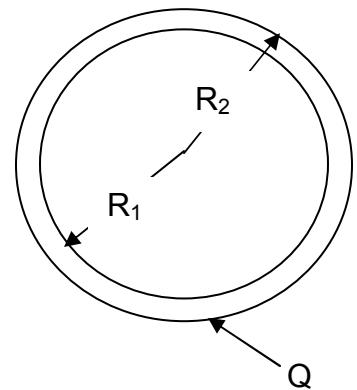
- I. The magnitudes of Q_1 and Q_2 are the same.
- II. The magnitude of Q_1 is 2 times larger than that of Q_2 .
- III. The magnitude of Q_1 is 4 times larger than that of Q_2 .
- IV. Q_1 and Q_2 have the same sign.
- V. Q_1 and Q_2 have different signs.

- a) I and IV are correct.
- b) II and IV are correct.
- c) II and V are correct.
- d) III and IV are correct.
- e) III and V are correct.

4. A hollow conducting sphere has an excess net charge of -2 nC . A point charge of -3 nC is placed at the center of the sphere. The charge distribution in the inner and outer surfaces of the sphere are respectively: (in nC):
- 0 and -2
 - $+3$ and -5
 - $+3$ and -2
 - $+2$ and -4
 - Another: Which one?

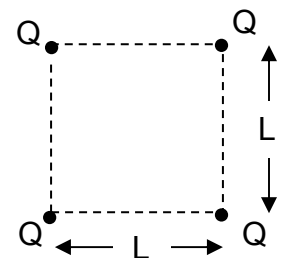
5. A hollow conducting sphere has an inner radius R_1 of 0.090 m and an outer radius R_2 of 0.100 m . The sphere has an excess net electric charge $Q = -3.00 \text{ nC}$ and there aren't any charges placed inside the sphere. The electric potential at the inner surface of the sphere (at a distance of 0.090 m from the center) is:

- -300 V
- -270 V
- 0
- 270 V
- 300 V



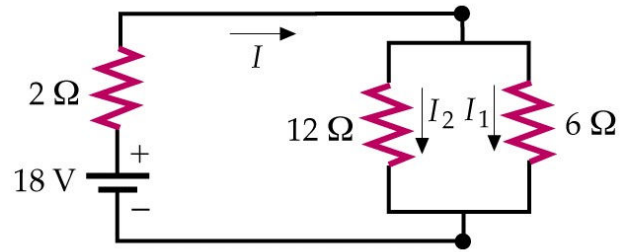
6. Four identical charges Q are placed at the corners of a square with sides equal to L . The total electric potential energy of the system of charges is:

- $k Q^2/L$
- $4k Q^2/L$
- $\sqrt{2} k Q^2/L$
- $(4 + \sqrt{2}) k Q^2/L$
- Another: Which one?



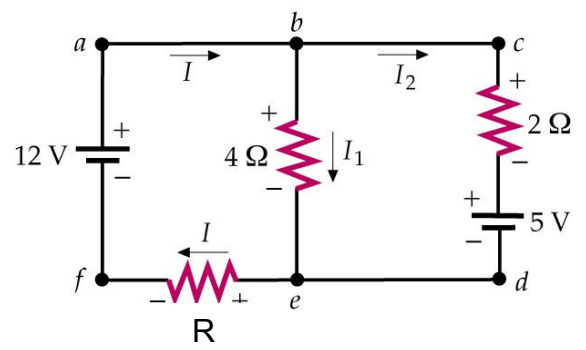
7. For the circuit shown at right the power dissipated in the 2.0Ω resistor is:

- a) 12 W
- b) 18 W
- c) 36 W
- d) 54 W
- e) Another: Which one?



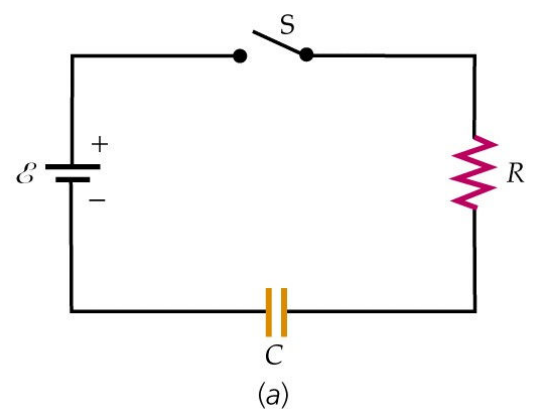
8. In the circuit shown in the figure at right the current I_1 is 1.5 A and the current I_2 is 0.50 A. For this to be so the value of resistance R has to be:

- a) 3.0Ω
- b) 4.0Ω
- c) 5.0Ω
- d) 6.0Ω
- e) Another: Which one?

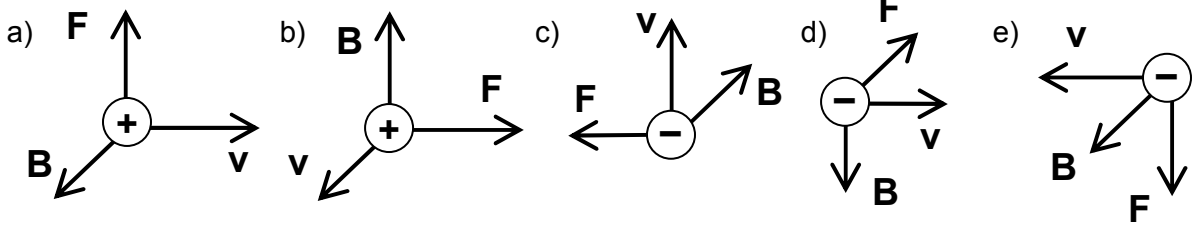
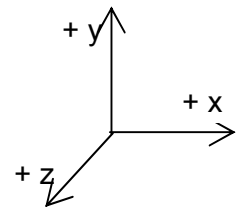


9. In the circuit shown in the figure at right $\mathcal{E} = 12 \text{ V}$, $R = 1.0 \text{ k}\Omega$ and $C = 2 \mu\text{f}$ and is not charged. At the instant $t = 0$ the switch S is closed and the capacitor begins to charge. The charge in the capacitor when the current in the resistance is 4.0 mA is:

- a) $4.0 \mu\text{C}$
- b) $8.0 \mu\text{C}$
- c) $16 \mu\text{C}$
- d) $32 \mu\text{C}$
- e) Another: Which one?

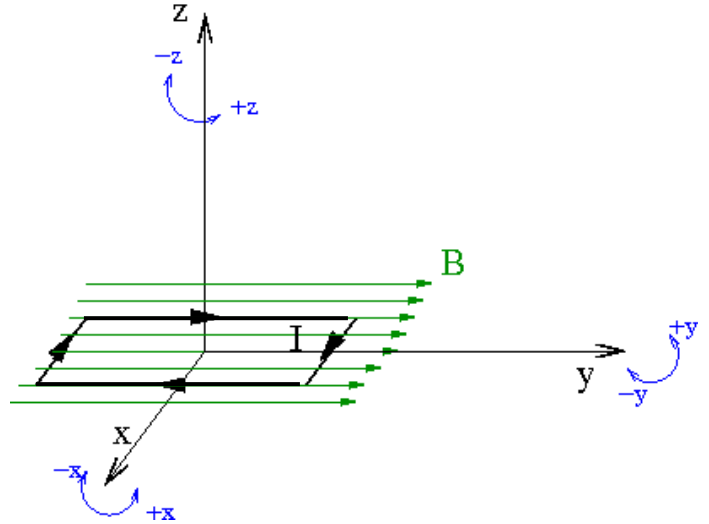


10. A charged particle is moving perpendicular to a magnetic field \mathbf{B} . Indicate which alternative has the correct directions? (For this question the justification is a formula or mathematical expression and a 'rule'.)



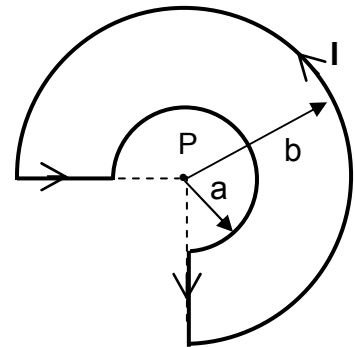
11. The direction of the torque on the current loop due to the magnetic field \mathbf{B} is: (For this question the justification is a formula or mathematical expression.)

- a) +x
- b) -x
- c) +y
- d) -y
- e) +z



12. A current loop with a current intensity I has the shape shown in the figure shown at right. If P is the center of both circular segments, then the vector that represents the intensity of the magnetic field \mathbf{B} generated by I at point P is: (a and b are the radii of both circular segments.)

- a) $(3\mu_0 / 8)(1/a + 1/b)$, out of the plane of the paper
- b) $(3\mu_0 / 8)(1/a + 1/b)$, into the plane of the paper
- c) $(3\mu_0 / 8)(1/a - 1/b)$, out of the plane of the paper
- d) $(3\mu_0 / 8)(1/a - 1/b)$, into the plane of the paper
- e) Another: Which one?



13. An RL circuit has a 6.0 mH inductor. At the instant the current is 5.0 A and its rate of change is 200 A/s, the rate with which the energy stored in the inductor is increasing is:
- a) 7.5×10^{-2} W
 - b) 3.0 W
 - c) 6.0 W
 - d) 120 W
 - e) 240 W
14. In an oscillating LC circuit, the total stored energy is U and the maximum charge on the capacitor is Q . When the charge on the capacitor is $Q/2$, the energy stored in the inductor is:
- a) $U/2$
 - b) $U/4$
 - c) $4U/3$
 - d) $3U/2$
 - e) $3U/4$
15. A cylindrical region with a 1.2 m radius contains a uniform electric field along the cylinder axis, which is increasing with time. To obtain a total displacement current of 2.0×10^{-9} A through a cross-section of the region, the magnitude of the electric field should change at a rate of:
- a) 5.0 V/s
 - b) 37 V/s
 - c) 50 V/s
 - d) 4.0×10^7 V/s
 - e) 12 V/s
16. An electromagnetic wave is generated by: (This question doesn't require justification.)
- a) any moving charge.
 - b) any accelerating charge.
 - c) only a charge with changing acceleration.
 - d) only a charge moving in a circle.
 - e) only a charge moving in a straight line.

17. The magnetic field in a sinusoidal light wave has an amplitude of 3.3×10^{-7} T. The intensity of the wave is:

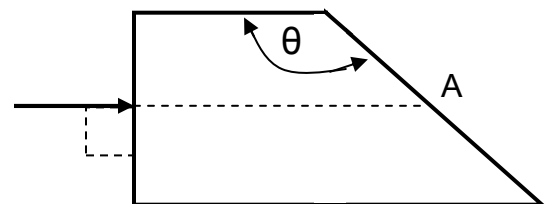
- a) 1.7×10^{-4} W/m²
- b) 13 W/m²
- c) 27 W/m²
- d) 1.0×10^5 W/m²
- e) 4.0×10^{10} W/m²

18. An object is placed 60 cm from a concave mirror with a radius of curvature of 20 cm. The lateral magnification is:

- a) 0.1
- b) 0.15
- c) -0.10
- d) 0.20
- e) -0.20

19. A beam of light is incident at 90° on the surface of an acrylic prism with an index of refraction $n = 1.56$. (see the figure at right). The beam continues travelling inside the prism until it reaches point A where it reflects totally internally. The minimum value of θ for this to happen is:

- a) 40°
- b) 50°
- c) 130°
- d) 150°
- e) Another: Which one?



20. An image is 4.0 mm in front of a converging lens with focal length 5.0 mm. The object is located at:

- a) 9.0 cm behind the lens.
- b) 2.2 mm in front of the lens.
- c) 20 mm in front of the lens.
- d) 2.2 mm behind the lens.
- e) 9.0 mm in front of the lens.

21. A double slit with a slit separation of 0.150 mm is placed at a distance of 1.50 m from a screen. Monochromatic light of certain wavelength is incident on the slit from a far away source. An interference pattern is observed on the screen where the separation between three consecutive maxima is 12.0 mm. The wavelength obtained from the data for the incident light is:

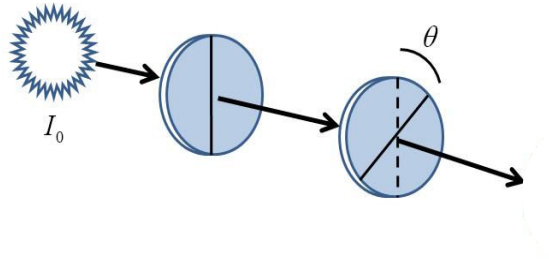
- a) 400
- b) 500
- c) 600
- d) 650
- e) Another: Which one?

22. Monochromatic light of certain wavelength from a far away source passes through a single slit 0.250 mm wide. A diffraction pattern with a central maximum 1.6 cm wide is observed on a screen 2.00 m away. This means that the wavelength of the light passing through the slit is in nm:

- a) 400
- b) 500
- c) 800
- d) 1000
- e) Another: Which one?

23. A non polarized light ray of intensity I_0 is incident on a polarizing filter whose transmission axis has a vertical orientation. (See the figure below.) The light ray continues traveling and impinges on a second polarizing filter whose transmission axis is rotated an angle θ with respect to the previous one. The intensity of the Light that emerges from the second polarizing filter $1/8 I_0$. The angle θ between the transmission axes is:

- a) 25.5°
- b) 30.0°
- c) 52.2°
- d) 60.0°
- e) Another: Which one?



24. The longest wavelength a photon can have to be able to extract an electron from a sodium plate is 540 nm. This means that the work function in eV for the sodium plate is.

- a) 1.80
- b) 2.30
- c) 3.35
- d) 4.60
- e) Another: Which one?

25. The kinetic energy in eV of an electron whose wavelength is 0.15 nm is:

- a) 10
- b) 67
- c) 447
- d) 1.1×10^{-17}
- e) Another: Which one?