

PHY 262 Exam 2**8/1/12**

This exam is closed book and closed notes, but open calculator. You have about 80 minutes to complete the exam (9:30 – 10:50). There are different types of questions, each with their own point values. The scantron sheet must be used to record ALL of the m/c and t/f answers. You must return your exam and the scantron to get credit for this exam. There are TWO versions of this exam (white and color). Please write the color of your exam somewhere on your scantron. You may write on the test.

*Be careful with your time.**Be careful with your time.**Be careful with your time.*

$$D = Vt \quad V_f^2 = V_i^2 + 2a(\Delta R) \quad V_f = V_i + at \quad R = R_0 + V_0 t + (1/2)at^2$$

$$\sin = \text{opp/hyp} \quad \cos = \text{adj/hyp} \quad \tan = \text{opp/adj} \quad g = 9.8 \text{ m/s}^2 \quad \text{Area} = \pi R^2$$

$$\text{Vol} = (4/3)\pi R^3 \quad \text{Cir} = 2\pi R \quad F = qE \quad \epsilon_0 = 8.85 \times 10^{-12} \quad \mu_0 = 4\pi \times 10^{-7}$$

$$E = kq/r^2 \quad E_x = -dV/dx \quad V = kq/r = (\text{Elec Pot Energy})/q \quad VC = Q \quad C = K\epsilon_0 A/d$$

$$\text{Cap energy} = (1/2)CV^2 \quad \text{proton mass} = 1.67 \times 10^{-27} \quad \text{electron mass} = 9.11 \times 10^{-31}$$

$$q = 1.6 \times 10^{-19} \quad \text{Avogadro's \#} = 6.02 \times 10^{23} \quad G = 6.67 \times 10^{-11} \quad k = 9 \times 10^9$$

$$R = (\rho)L/A \quad \text{Watt} = \text{Joule/sec} \quad \text{Volt} = \text{Joule/Coul.} \quad \text{Kin Energy} = mv^2/2$$

$$I = dq/dt \quad \Delta V = IR \quad P = IV \quad I = nqvA \quad F_{\text{cir}} = mv^2/R$$

$$R(\text{series}) = \text{add} \quad R(\text{parallel}) = \text{add inverses} \quad \text{Vice-versa for caps}$$

$$\Phi = \text{Flux} = E \cdot A \text{ or } B \cdot A \quad \text{Gauss' Law: } \oint E \cdot dA = q(\text{enclosed})/\epsilon_0 \quad J = \sigma E = I/A$$

$$p = 2aq \quad \tau = p \times E \quad U = -p \cdot E \quad C = KC_0 \quad \Delta V_{ab} = -\int_a^b E \cdot dS$$

$$(\text{epsilon}) = (\text{dielectric const}) \cdot \epsilon_0 \quad \text{Energy} = (1/2)(\text{epsilon})E^2 \quad F = il \times B = qv \times B$$

E creates I, I creates B, delta B creates (-)E, and delta E creates B

$$V/N)_{\text{pri}} = V/N)_{\text{sec}} \quad IV)_{\text{pri}} = IV)_{\text{sec}} \quad \text{Energy density } u = (1/2) \epsilon_0 E^2 = B^2 / (2\mu_0)$$

$$-(d/dt) \Phi_B = \oint E \cdot ds \quad \oint B \cdot dA = 0 \quad \oint B \cdot ds = (\mu_0)I_{\text{encl}} + (\mu_0 \cdot \epsilon_0)(d/dt) \Phi_E$$

$$(\mu_0 \cdot \epsilon_0) = 1/c^2 \quad c = 3 \times 10^8 \text{ m/s} \quad E/B = c \quad S = (\mu_0)^{-1} E \times B \quad \text{Absorb Pressure} = S/c$$

am, fm, microwaves, IR, royg biv, UV, x-rays, gamma, cosmic rays = family of EM

lambda, sigma, rho = charge per unit length, area, volume $c = \lambda f$

Answer **“a” = true** **“b” = false**

- 1) A static magnetic field could move (set into motion) a charged particle originally at rest?
- 2) Two parallel wires (on tall poles) are carrying a steady current in the same direction. They will put a force on each other. That force is/will: (Hint: Newton's 3rd Law)
 - a) attractive
 - b) repulsive
 - c) cause one wire to go up, and the other down
 - d) cancel out—so there is no net force on either wire

3) A long, straight wire is carrying a steady current in the “north” direction. That current will create a B field. In what direction will that B field be to an observer standing just to the left (west) side of the wire, and at the same vertical location, or height, of the wire?

- a) up
- b) east
- c) west
- d) south
- e) down

4) For the previous question: The person holds a standard compass, level and horizontally, at the same height of the wire. How will that compass respond—in what direction will it point?

- a) the compass cannot point ‘that’ way
- b) east
- c) west
- d) south
- e) down

5) For the person holding the level compass in the previous problem, where would the person need to hold the compass so that the compass would point towards the east direction?

- a) left of the wire
- b) right of the wire
- c) above the wire
- d) below the wire
- e) there is no way to make this happen in this geometry

8) Fingerprints can be detected on any surface with magnetic powder. The powder is coated with an organic material that adheres to the greasy fingerprint, and excess powder is removed with a magnet.

a) true

9) What is the path of a charged particle in a uniform magnetic field if the initial velocity is 90 degrees to the field direction?

- a) straight line—keeps moving in the same direction
- b) bends to point in the direction of B
- c) bends to point in the opposite direction of B
- d) circular, so that v maintains its original 90 degrees to B
- e) a spiral

10) What is the path of a charged particle in a uniform magnetic field if the initial velocity is parallel to the field direction?

- a) straight line—keeps moving in the same direction
- b) bend to point in the direction of B
- c) bend to point in the opposite direction of B
- d) circular, so that v maintains its original 90 degrees to B
- e) a spiral

- 11) What is the path of a charged particle in a uniform magnetic field if the initial velocity is arbitrary/random/various/skew to the field direction?
- straight line—keeps moving in the same direction
 - bend to point in the direction of B
 - bend to point in the opposite direction of B
 - circular, so that v maintains its original 90 degrees to B
 - a spiral
- 12) We know that the Earth creates a B field. What does 'science' say is the accepted reason?
- the Earth is a magnet
 - the Earth has changing E fields inside of it
 - the Earth has currents inside of it
- 13) Which has more energy, the E or the B field in an electromagnetic wave?
- E
 - B
 - it depends on which part of the spectrum the wave is located.
 - they have the same energy.
- 16) Is the north or the south pole of a compass associated with positive charges?
- The N side of the compass is associated with positive charges.
 - The S side of the compass is associated with positive charges.
 - Neither. There is no relationship between "poles" and the sign of charges.
- 19) When Faraday first began playing around with what later became known as transformers, he arranged for a DC current, with a switch, to be connected to one side, and an ammeter on the other. What did he find?
- No current would register on the ammeter when the DC circuit was operating.
 - A blip of current would register on the ammeter when the switch was closed.
 - A blip of current would register on the ammeter when the switch was opened.
 - All of the above.
- 20) A piston-driven engine drives the propeller of an airplane. The rotating crankshaft contains magnets that generate currents in adjacent coils of wire. This current can be used to spark the gasoline, allowing the engine to operate even if all other batteries and generators in the plane fail. This is an extra safety feature that is not really needed in cars.
- a) true**
- 21) The energy of FM radiation is large enough to break chemical bonds.
- 22) In visible light, the E and B field both oscillate hundreds of trillions of times per second.
- 23) Iron would be repelled by a current carrying solenoid.
- 24) B lines can "wiggle around" but must always come back on themselves.

- 25) A circular current, because it comes back on itself, does not create a magnetic field.
- 26) By breaking a magnet in half, one could have separate N and S poles.
- 27) A compass needle is itself a permanent magnet.
- 28) A current passed through a metal spring will tend to contract the spring.
- 29) Iron can only be attracted to the N pole of a magnet.
- 30) **What does Gauss's Law for magnetism mean physically.**
- a) That there are no magnetic monopoles.
 - b) That B lines always eventually grab their own tails.
 - c) That E fields and B fields are really the same thing.
 - d) Both a) & b) above.
 - e) All of the above.
- 31) **The force on an electron moving north in a B field pointing east is**
- a) south.
 - b) up.
 - c) west.
 - d) down.
 - e) cannot be determined.
- 51) Figure 31.18 in your ebook shows a transformer with (perhaps) 4 turns on the primary side, and choose a nice number) 12 on the secondary side. The primary is connected to a 120 volt line from a Public Service wall socket. What is the output voltage on the secondary side?
- a) zero volts
 - b) 120 volts
 - c) 40 volts
 - d) 360 volts
 - e) 480 volts
- 52) If this transformer's input voltage is 120 VAC, and the input current is 3 amps, find the output current.
- a) zero amps
 - b) 9 amps
 - c) 1 amp
 - d) 3 amps
 - e) cannot be determined

53) A wedding ring is dropped as shown in our quiz or in your mind. It first falls through a region with no B, then strong B, pointing into the page, and then no B again. What is happening to the ring as it begins to leave the B-field region?

- a) The ring gets an upwards force
- b) The ring gets a downwards force
- c) A counterclockwise current is induced.
- d) A clockwise current is induced.
- e) Nothing happens to, or in, the ring.

54) A power plant and its transmission lines are shown. What is located at the following indicated position in the figure? You will have to come to class to see this picture.....

- a) a step-up transformer
- b) a step-down transformer
- c) a capacitor
- d) a resistor
- e) an inductor

55) Transcranial Magnetic Induction can be used to disrupt unwanted currents in the brain.

- a) **true**

56) A common TV set shoots electrons towards a screen. Electrons are deflected both left/right and up/down by B fields. Why not use (two) E fields?

- a) E fields could not be made strong enough to steer the electrons as much as needed.
- b) The E field would create a health/shock hazard.
- c) The two E fields would interfere with each other.
- d) E fields change the energy of the electron beam, and would brighten the center of the screen.
- e) E fields change the energy of the electron beam, and would brighten the perimeter of the screen.

57) It is fairly easy to understand how the proton and the electron have magnetic fields around them. They are charged, and if they move or “spin”, that is current. End of story! However, what clue about the neutron is nature giving us when we also find that neutrons have B fields? In other words, neutrons really do create magnetic fields, but if they are made out of “neutral” stuff, then how can there be any currents inside of the neutron to make that magnetic field? What clue is nature giving us?

- a) That currents must not really produce B fields.
- b) That the neutron must really be a charged particle after all.
- c) That the neutron is a composite object—the neutron is made up of more than one particle.

58) Your FM radio can get stations whose frequencies are approximately 100 MHz. What is the wavelength of such an electromagnetic wave?

- a) 3×10^6 meters c) 3×10^{10} meters e) 1×10^8 meters
 b) 3 meters d) 3×10^{16} meters

59) A square-shaped 'loop' of wire is placed near a long, straight wire.

There is current in both wires, with the current in the loop's nearest segment being parallel to the wire's current. Call the segment closest to the wire AB, and then BC is the part of the square loop that is perpendicular to the wire, CD is parallel but running 'backwards'.

Which of the following statements is most true?

- a) Segment AB of the loop is attracted to the wire, while segment CD is repelled. Since the current in each segment is identical, and their lengths are the same, the net force is zero.
 b) There is an upwards (out of the paper) force on segment BC, and a downwards (into the paper) force on segment DA.
 c) There is a downwards force on segment BC, and an upwards force on segment DA.
 d) Statement (a) is almost true; segment CD is further away, and hence in a larger B field. The repulsive force is therefore larger than the attraction.
 e) Statement (a) is almost true; segment CD is further away, and hence in a smaller B field. The repulsive force is therefore smaller than the attraction.

Answers:

- 1 b
 2 a
 3 a
 4 a
 5 c
 8 a
 9 d
 10 a
 11 e
 12 c
 13 d
 16 c
 19 d
 20 a
 21 b
 22 a
 23 f
 24 t
 25 f
 26 f
 27 t
 28 t
 29 f

30 d

31 d

51 d

52 c

53 d

54 see class notes regarding location of step-up and down transformers.

Step up before you ship the power, and step down near destination.

55 a

56 e

57 c

58 b

59 e

I will give you a picture of a loop of wire tilted in a B field may ask for flux, force on one of the wires, magnetic dipole moment of the loop and the torque.

Know the 2-thingy and the 3-thingy right hand rule.

Be able to draw the B lines for a circle of current and for a straight-line of current.

I will ask you to solve for the changing flux if either the B or A or theta changes.

Know how to do the 'wire slides on the 2 rails' kind of problems....

There are 50 questions worth 2 points each and one written question.

Best wishes,

dc