PHYSICS DEPARTMENT, FACULTY OF SCIENCE, MENOUFIA UNIVERSITY
FINAL TERM EXAM, COURSE: ELECTROMAGNETISM, P145
EXAM DATE: 30/12/2017 TIME ALLAWED 2 HOURS

جامعة المنوفية

Answer All Questions

PART I USING WHAT YOU HAVE LEARNED, PLEASE CHOOSE THE BEST ANSWER TO EACH OF THE FOLLOWING (35) QUESTIONS AND INDICATE YOUR CHOICE ON THE ANSWER SHEET. (Multiple choice 60 Pts.) (2 pts. each)

1.	When a glass rod is rubbed with silk and becomes positively charged, a. electrons are removed from the rod. b. protons are removed from the silk. c. protons are added to the silk. b. the silk remains neutral.	Ⓐ Ⓑ Ⓒ Ⓓ
2.	When there is an equal amount of positive and negative charges on an object, the object is a. positively charged. c. neutral. b. negatively charged. d. supercharged.	Ⓐ Ⓑ Ⓒ Ⓓ
3.	Electric force varies depending on the a. charge and distance between charged objects. b. charge and mass of charged objects. c. height and mass of charged objects. d. mass and distance between charged objects.	Ⓐ Ⓑ Ⓒ Ⓓ
4.	The electric field lines around a negatively charged particle a. cross positively charged particle field lines. b. cross negatively charged particle field lines. c. always point inward. d. always point outward.	Ⓐ Ⓑ Ⓒ Ⓓ
5.	When compared to a –2 charge, there are a. an equal number of field lines pointing inward toward a +4 charge. b. twice as many field lines pointing inward toward a +4 charge. c. twice as many field lines pointing outward from a +4 charge. d. half as many field lines pointing outward from a +4 charge.	Ⓐ Ⓑ Ⓒ Ⓓ
6.	An electric current is produced when charges are accelerated by an electric field to move to a position of potential energy that is a. higher. c. equal. b. lower. d. infinite.	Ⓐ Ⓑ Ⓒ Ⓓ
7.	Current is the rate at which charges move through a a. conductor. c. voltage. b. insulator. d. joule.	Ⓐ Ⓑ Ⓒ Ⓓ
8.	Which of the following does *not* affect a material's resistance? a. length c. the type of material b. temperature d. Ohm's law	Ⓐ Ⓑ Ⓒ Ⓓ
9.	What is the potential difference across a resistor that dissipates 5.00 W of power and has a current of 5.0 A? a. 1.0 V c. 4.00 V b. 125 V d. 0.20 V	Ⓐ Ⓑ Ⓒ Ⓓ
10	The resistance of an insulator is a. absent. c. moderate. b. very low. d. high.	Ⓐ Ⓑ Ⓒ Ⓓ

11	Which of the following shows how conductors, insulators, superconductors, and semiconductors rank in order of least resistance to most resistance? a. superconductors, conductors, semiconductors, insulators b. semiconductors, superconductors, conductors, insulators c. insulators, conductors, semiconductors, superconductors d. none of the above	Ⓐ Ⓑ Ⓒ Ⓓ
12	Magnetically soft substances a. retain their magnetism longer than others. b. lose their magnetism more easily than others. c. cannot be magnetized easily. d. pick up more iron nails than magnetically hard substances.	Ⓐ Ⓑ Ⓒ Ⓓ
13	The north pole of one magnet will be a. attracted to the north pole of another magnet. b. attracted to the south pole of the same magnet. c. repelled by the north pole of another magnet. d. repelled by the south pole of another magnet.	Ⓐ Ⓑ Ⓒ Ⓓ
14	Like magnet poles always a. repel each other. b. attract each other. c. cancel out each other's magnetic fields. d. point toward the north pole.	Ⓐ Ⓑ Ⓒ Ⓓ
15	Electric force varies depending on the: a. charge and distance between charged objects. b. charge and mass of charged objects. c. height and mass of charged objects. d. mass and distance between charged objects.	Ⓐ Ⓑ Ⓒ Ⓓ
16	Tesla is a unit for measuring: a. Magnetic moment b. Magnetic induction c. Electric potential d. Magnetic intensity	Ⓐ Ⓑ Ⓒ Ⓓ
17	Force on current carrying conductor placed in uniform magnetic field is equal to: a. IL x V b. IL/B c. IL x b d. Iq x B	Ⓐ Ⓑ Ⓒ Ⓓ
18	State Gauss's law in words. a. the flux through a closed surface is always zero. b. the flux through a closed surface is proportional to the net enclosed charge. c. the flux for a closed surface cannot be calculated. d. the flux through a closed surface is infinite.	Ⓐ Ⓑ Ⓒ Ⓓ
19	The magnitude of the electric field at a point in space is equal to a. the force that would be felt by a proton if placed at that point b. the force that would be felt by a electron if placed at that point c. the force that would be felt by a test charge if placed at that point d. the force per unit charge at that point	Ⓐ Ⓑ Ⓒ Ⓓ
20	Consider Coulomb's law for point charges. The statement that $F_{12}=-F_{21}$ is an example of which of the following facts? a. Coulomb's law obeys the principle of superposition. b. Coulomb's law obeys Newton's 3rd law of motion. c. Coulomb's law is an inverse-square law. d. Coulomb's law has a very large constant of proportionality.	Ⓐ Ⓑ Ⓒ Ⓓ

21	A solid block of metal is placed in a uniform electric field. Which statement is correct concerning the electric field in the block's interior? a. The interior field points in a direction opposite to the exterior field. b. The interior field points in a direction that is at right angles to the exterior field c. The interior field points in a direction that is parallel to the exterior field d. The is no electric field in the block's interior	Ⓐ Ⓑ Ⓒ Ⓓ
22	Several electrons are placed on a hollow conducting sphere. They a. clump together on the sphere's outer surface b. clump together on the sphere's inner surface c. become uniformly distributed on the sphere's outer surface d. become uniformly distributed on the sphere's inner surface	Ⓐ Ⓑ Ⓒ Ⓓ
23	Every charged particle produces a. a negative charge. b. a magnetic field. c. a positive charge. d. an electric field..	Ⓐ Ⓑ Ⓒ Ⓓ
24	A current carrying conductor placed in external magnetic field experiences _____force. a. Magnetic b. Attracting c. Electric d. Pushing	Ⓐ Ⓑ Ⓒ Ⓓ
25	A magnetic field line is used to find the direction of a. south-north b. a bar magnet c. a compass needle d. magnetic field	Ⓐ Ⓑ Ⓒ Ⓓ
26	The magnetic field lines due to a straight wire carrying a current are a. straight b. circular c. parabolic d. elliptical	Ⓐ Ⓑ Ⓒ Ⓓ
27	Magnetic field produced at the centre of a current carrying circular wire is a. directly proportional to the square of the radius of the circular wire b. directly proportional to the radius of the circular wire c. inversely proportional to the square of the radius of the circular wire d. inversely proportional to the radius of the circular wire	Ⓐ Ⓑ Ⓒ Ⓓ
28	The magnetic field lines inside a long, current carrying solenoid are nearly a. straight b. circular c. parabolic d. elliptical	Ⓐ Ⓑ Ⓒ Ⓓ
29	A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid a. will become zero b. will decrease c. will increase d. will remain unaffected	Ⓐ Ⓑ Ⓒ Ⓓ
30	The direction of the force on a current-carrying wire placed in a magnetic field depends on a. the direction of the current b. the direction of the field c. the direction of current as well as field d. neither the direction of current nor the direction of field.	Ⓐ Ⓑ Ⓒ Ⓓ

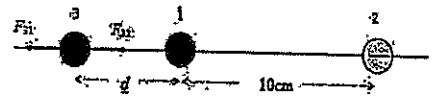
31	In an electric motor, the energy transformation is from a. electrical to chemical b. chemical to light c. mechanical to electrical d. electrical to mechanical	Ⓐ Ⓑ Ⓒ Ⓓ
32	For making a strong electromagnet, the material of the core should be a. soft iron b. steel c. brass d. copper	Ⓐ Ⓑ Ⓒ Ⓓ
33	Magnetic field inside a long solenoid carrying current is a. same at all points (uniform) b. different at poles and at the centre c. zero d. different at all points	Ⓐ Ⓑ Ⓒ Ⓓ
34	You have a coil and a bar magnet. You can produce an electric current by a. moving the magnet but not the coil b. moving the coil but not the magnet c. moving either the magnet or the coil d. using another DC source	Ⓐ Ⓑ Ⓒ Ⓓ
35	The magnetic lines of force inside a current carrying solenoid are a. along the axis and parallel to each other b. perpendicular to the axis and parallel to each other c. circular and do not intersect each other d. circular and intersect each other	Ⓐ Ⓑ Ⓒ Ⓓ

PART II (Electricity 60 Pts.)

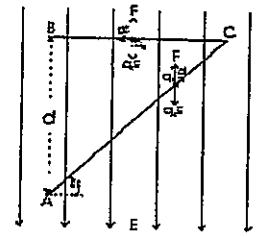
1-a. Calculate The Electric field due to dipole at a point on the perpendicular bisector of the axis of the dipole (10 pts.).

1-b. Calculate the value of two equal charges if they repel one another with a force of 0.1 N when situated 50 cm apart in a vacuum. (5 pts.).

1-c. Two fixed charges, 1μC and -3μC are separated by 10cm as shown in figure, where may a third charge be located so that no force acts on it? (b) is the equilibrium stable or unstable for the third charge? (5 pts.).



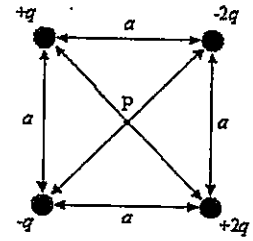
2-a. In figure the test charge moved from A to B along the path shown. Calculate the potential difference between A and B. (5 pts.).



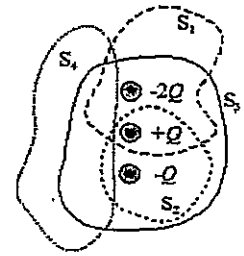
2-b. A solid cylindrical conductor of radius a and charge Q is coaxial with a cylindrical shell of negligible thickness, radius $b>a$, and charge $-Q$. Find the capacitance of this cylindrical capacitor if its length is l. (15 pts.).

3-a. A disk of radius R has a uniform surface charge density σ. Calculate the electric field at a point P that lies along the central perpendicular axis of the disk and a distance x from the center of the disk. (10 pts.).

3-b. What is E in magnitude and direction at the center of the square shown in figure? Assume that q=1μC and a=5cm. (5 pts.).



3-c. Four closed surfaces, S_1, through S_4, together with the charges -2Q, +Q, and -Q are sketched in figure. Find the electric flux through each surface. (5 pts.).



PART II (Magnetism 60 Pts.)

4. A long, straight wire of radius R carries a steady current I that is uniformly distributed through the cross section of the wire. Calculate the magnetic field a distance r from the center of the wire in the regions $r > R$ and $r < R$. (15 Marks)

5. A device called a *toroid* is often used to create an almost uniform magnetic field in some enclosed area. The device consists of a conducting wire wrapped around a ring (a *torus*) made of a nonconducting material. For a toroid having N closely spaced turns of wire, calculate the magnetic field in the region occupied by the torus, a distance r from the center. (15 Marks)

6. Consider a circular wire loop of radius R located in the yz plane and carrying a steady current I. Calculate the magnetic field at an axial point P a distance x from the center of the loop. (15 Marks)

7. Consider two long, straight, parallel wires separated by a distance a and carrying currents I_1 and I_2 in the same direction, as shown in Figure. Calculate the Magnetic Force between the two parallel conductors. (15 Marks)

WITH MY BEST WISHES, PROF. MEAWAD MOHAMED ELKHOLY AND DR. SAMIA ELSAYED IBRAHIM