Name:

Grade and Section: Score: /70.0

Date of the Examination:

Third Quarter Examination for General Physics 2

NEWTON SCHOOL OF BRIGHT MINDS INC.

GENERAL INSTRUCTIONS:

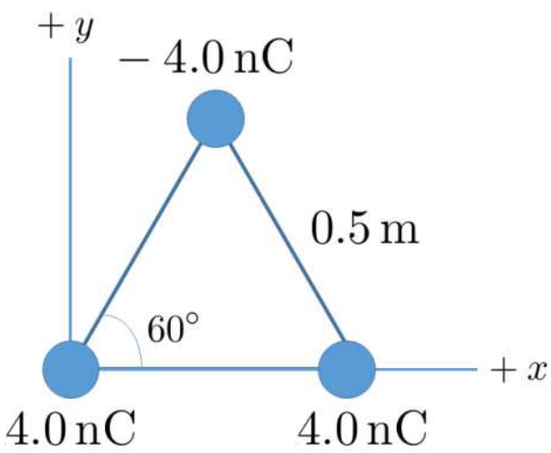
1.) Use No. 2 pencil only to shade your answer to the answer sheet. To change your answer, neatly erase your old answer and shade the new one. You may request a scratch paper from the proctor whenever you need to.
2.) Do not write anything on the questionnaire. On page 7, you will see the equation sheet for the entire examination.
3.) Scientific calculators are allowed while other electronic devices are prohibited.
4.) Any form of cheating in examinations or any act of dishonesty in relation to studies shall be subject to disciplinary action.
5.) This examination is good for 2 hours. Following instructions is part of the exam.

I. Multiple Choice. Shade the letter of the BEST answer on your answer sheet (20 items).

1. What is the movement of electrons based from the diagram after a positively charged rod is placed near the knob?

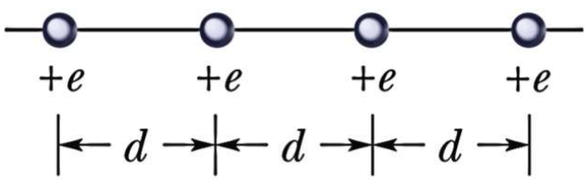
(a) Rod to leaves
(b) Leaves to knob
(c) Knob to leaves, then back to knob
(d) Leaves to knob, then back to leaves

2. Three charges are at the corners of an equilateral triangle of side length 0.5 m as shown. What is the direction of the net electric field produced by these charges at the center of the triangle?



(a) +x-direction
(b) -x-direction
(c) +y-direction
(d) -y-direction

3. Four protons are placed along a line with each adjacent charges separated a distance d apart. What is the magnitude of the net electrostatic force experienced by the leftmost proton?

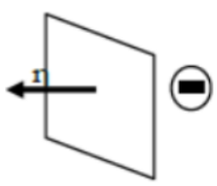


(a) $\frac{1}{14}k\frac{e^2}{d^2}$
(b) $\frac{49}{36}k\frac{e^2}{d^2}$
(c) $\frac{11}{6}k\frac{e^2}{d^2}$
(d) $3\,k\frac{e^2}{d^2}$

4. Charge q1 (26.0 µC) and q2 (-47.0 µC) experienced an electrostatic force of 5.70 N between them at a distance of what (in meters)?

(a) 1.39
(b) 1.93
(c) 2.14×10^{-19}
(d) 1.464×10^{-8}

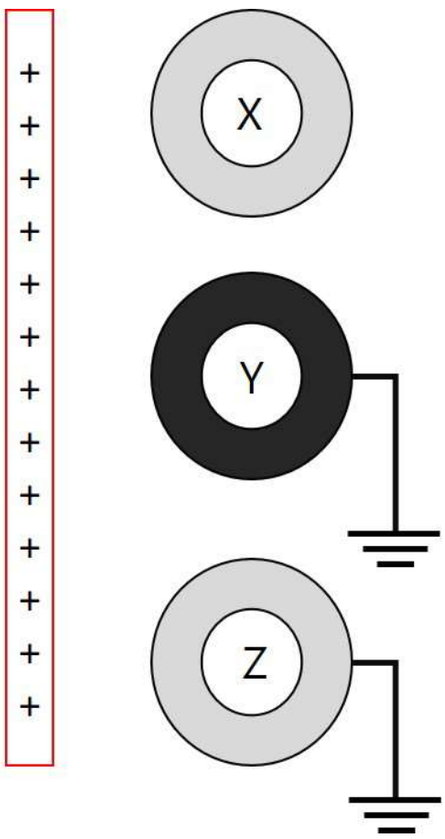
5. What does the diagram below show about the electric flux through the surface?



(a) Zero
(b) Positive
(c) Negative
(d) Unknown

6. Consider neutral rings X, Y, and Z as shown. X and Z are conductors while Y is an insulator. Both Y and Z are grounded. A positively charged rod is brought near the three rings. The ground wires are then cut from Y and Z. Which of the following is/are TRUE after the rod is removed?

I. X will be attracted to positively charged objects.
II. Y will be attracted to negatively charged objects.
III. Z will have a net positive charge.



a) I only
b) III only
c) I, II, and III
d) I and II only

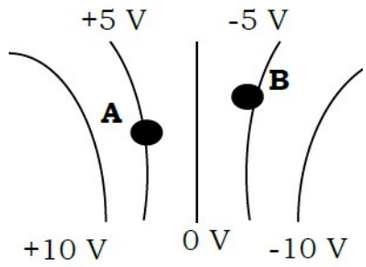
7. What is the change in potential energy when a + 3.5C point charge was moved from a negative plate to a positive plate with a potential difference of 8V?

a) 28 J
b) 0.4375 J
c) 2.29 J
d) 0 J

8. Four positive charges of equal magnitude were placed in each corner of a square. What will be the electric potential at the center of the square?

a) zero
b) $4k\frac{q}{r}$
c) $8\sqrt{2}k\frac{q}{r}$
d) $4\sqrt{2}k\frac{q}{r}$

9. **For questions 9 and 10**, refer to the diagram. Suppose a negative charge was moved from points A to B. What is work done along the path given the equipotential diagram?



a) increasing
b) decreasing
c) zero
d) Incomplete information

10. What is the direction of the electric field at point A?

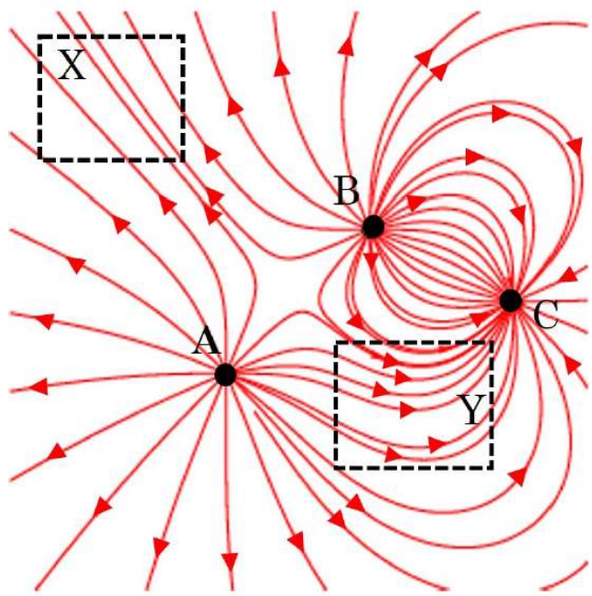
a) upward
b) downward
c) right
d) left

11. What is the magnitude of the electric field between parallel plates with 25 V of potential difference and placed 25 cm apart?

a) 1 N/m
b) 1 V/C
c) 1 N/C
d) 1 Nm/C

12. Consider the electric field lines of three point charges A, B, and C as shown. Which of the following is/are TRUE?

I. The electric field magnitude at region X is stronger than in region Y.
II. Point charges A and C have opposite signs.
III. Point charge B is negative.



a) I only
b) II only
c) I and III only
d) II and III only

13. A charge was removed from one of the plates. What is the change in the capacitance of the capacitors?

(a) it decreases (b) it stays the same
(c) increases (d) it is halved

14. A battery of emf and internal resistance is connected to the resistance R. If R = r, then what is the effect on the circuit?

(a) there is a low current (b) there is a higher current
(c) the power dissipated is lower (d) the power dissipated is higher

15. A 20 V potential difference is applied in a series combination of a 10 Ω and a 30 Ω resistors. What is the current in the 10 Ω resistor?

(a) 0.5 A (b) 0.3 A
(c) 0.67 A (d) 0.2 A

16. What is the potential difference across the 10 Ω resistor in No. 15?

(a) 5V (b) 10V
(c) 15V (d) 20V

17. Which of the following factors will affect the strength of the solenoid?

(a) number of wraps (b) strength of current
(c) wire thickness (d) core type

18. The magnetic field 2 cm from a long, straight wire is 10^{-6} T. What is the current in the wire?

(a) 0.1 A (b) 100 A
(c) 1000 A (d) 0.0001 A

19. The observer moves past a stationary electron. What could he only measure given the instruments the observer brought?

(a) magnetic field (b) electric field
(c) both electric and magnetic field (d) any of the above

20. The vertical parallel metal rods of a microwave filter oscillates currents in the rods. Sometimes, they have the same magnitude and direction of current. At that instant, what will happen to the rods?

(a) move apart horizontally (b) move together horizontally
(c) shift vertically downwards (d) shift vertically upwards

II. True or False. Shade "a" if the statement is True and shade "b" if the statement is False on your answer sheet. (20 points)

21. Material B has become positively charged after rubbing it with Material A. It can be conclude that Material B loses protons.

(a) True (b) False

22. Consider a solid conducting sphere with radius R and uniform surface charge density. A spherical Gaussian surface with radius r is concentric with the conducting sphere. If r < R, the electric field on the Gaussian surface is zero.

(a) True (b) False

23. A dielectric can increase the intensity of the electric field of a capacitor.

(a) True (b) False

24. A parallel plate capacitor has an energy of 2.5 J. It must be placed in a potential difference of 150 V.

(a) True (b) False

25. The energy of a charged capacitors can be found in the electric field.

(a) True (b) False

26. Current is the rate of the motion of charges with unit SI unit of Amperes.

(a) True (b) False

27. The temperature of wire made from copper is increased. The resistance decreases.

(a) True (b) False

28. Suppose that there is a current in a simple circuit. If both voltage and resistance are reduced by half, the current will quadruple.

(a) True (b) False

29. Semiconductors and diodes are examples of ohmic conductors.

(a) True (b) False

30. Electromotive force (EMF) is a vector quantity with unit of Newton (N).

(a) True (b) False

31. Ammeter is used to measure voltage in a given circuit.

(a) True (b) False

32. Electric field is perpendicular to the magnetic field.

(a) True (b) False

33. Magnetic field creates a charge around a magnet in motion.

(a) True (b) False

34. Electric charge creates electric field that is parallel to the magnetic field.

(a) True (b) False

35. Magnetic fields never do work. Since work causes an object's kinetic energy to change, no net work means no change in speed.

(a) True (b) False

36. The magnetic force, acting perpendicular to the velocity of the particle, will cause centripetal motion.

(a) True (b) False

37. Gyrofrequency refers to the number of cycles a particle completes around its circular circuit every second.

(a) True (b) False

38. Electric current in a circular loop creates a magnetic field which is more concentrated in the center of the loop than outside the loop.

(a) True (b) False

39. Ampere's law states how the value of the magnetic field at a specific point in space from one short segment of current-carrying conductor depends on each factor that influences the field.

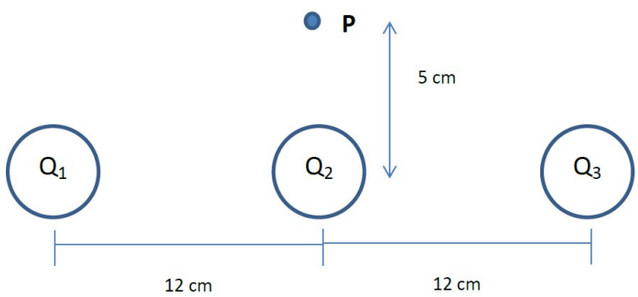
(a) True (b) False

40. Biot-Savart Law implies that the magnetic field created by an electric current is inversely proportional to the size of that electric current.

(a) True (b) False

III. Problem Solving. Solve each of the following problems and follow specific instructions per items. Box your final numerical answer on the answer sheet. (25 points)

For items 41 and 42, consider a system of point charges shown in the figure below. $Q_1 = 3\ \mu C$, $Q_2 = -2\ \mu C$, and $Q_3 = 3\mu C$ are arranged in a line.



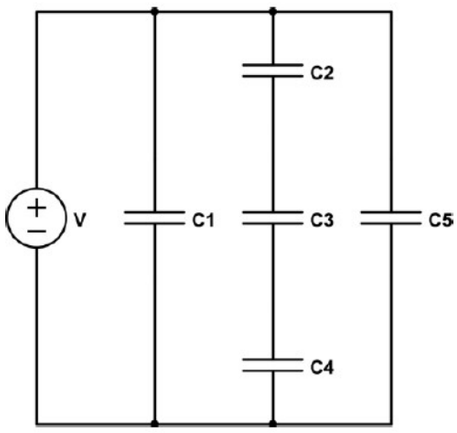
41. What is the electric field at P due to Q1? Show your solution and final answer with correct unit (1 point).

42. If a 3 μC charge is placed at point P, what is the net force that it will experience due to the three charges? Show your solution and final answer with correct unit (1 point).

For items 43 and 44. Calculate the closest distance an alpha particle with charge 3.2×10^{-19} C can get to a gold nucleus with charge 1.26×10^{-17} C, given that the alpha particle has an initial kinetic energy of 6.1×10^{-13} J. You can use the blanks for 43 and 44 on your answer sheet for your solution. (2 points)

43. Given and Required (1 point):

44. Solution with final answer (1 point):



For item 45. Consider five capacitors, C1 = C5 = 3μF, C2 = C3 = C4 = 6μF, connected as shown in the figure. After fully charging the circuit, the 9V battery is then disconnected. What is the effective capacitance of this circuit?

45. Show your solution and final answer with correct unit (1 point).

For items 46 and 47. A parallel-plate capacitor has a potential difference of 2000V. After an insulator was placed between its plates, the potential decreases to 500V. What is the dielectric constant of the insulator? You can use the blanks for 46 and 47 on your answer sheet for your solution. (2 points)

46. Given and Required (1 point):

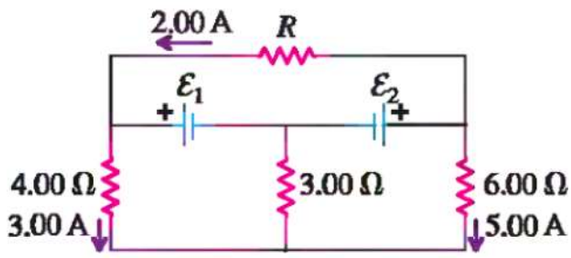
47. Solution with final answer (1 point):

For the items 48-50, consider an electrical conductor having a square cross-section of side 1.0 mm and length 10.0 m. The resistance between its ends is 0.20 Ω.

48. What is the resistivity of the material? Show your solution and final answer with correct unit (1 point)

49. If the electric field magnitude in the conductor is 2.0 V/m, what is the total current? Show your solution and final answer with correct unit (1 point)

50. If the line voltage drops to 100 V, what power does the heater take? Assume that the resistance is constant. Show your solution and final answer with correct unit (1 point)



For items 51-53. Consider the circuit shown. Using Kirchhoff's junction rule, what is the current through the 3.00-Ω resistor? You can use the blanks for 51, 52 and 53 on your answer sheet for your solution. (3 points)

51. Given (1 point):

52. Required (1 point):

53. Solution with final answer (1 point):

For items 54 to 58. A resistor with resistance 10 MΩ is connected in series with a capacitor with capacitance 1.0 μF and a battery with emf 12.0 V. Before the switch is closed at time t = 0, the capacitor is uncharged. What is the time constant? You can use the blanks for 54-58 on your answer sheet for your solution. (5 points with correct units)

54. Given (1 point):

55. Required (1 point):

56. Solution with equation and correct substitution (1 point):

57. Final Answer with correct unit (1 point):

58. Final Answer with correct unit written in 2 significant figures (1 point).

59. The magnetic field at a distance of 2 cm from a straight wire is 0.00002 T. What is the current in the wire? Show your solution and final answer with correct unit (1 point)

For items 60-62. A coil used to produce a magnetic field for an electron beam experiment has a radius of 12 cm and has 200 turns. What current is needed to produce a magnetic field of 5.0×10^{-3} T? You can use the blanks for 60-62 on your answer sheet for your solution.

60. Given (1 point):

61. Required (1 point):

62. Solution with final answer (1 point):

For items 63-65. A circular coil of wire 0.0500 m in radius, having 30 turns, lies in a horizontal plane. It carries a current of 5.00 A in a counterclockwise rotation when viewed from above. The coil is in the magnetic field directed towards the right with a magnitude of 1.20 T. Find the magnetic moment and the torque on the coil. You can use the blanks for 63-65 on your answer sheet for your solution.
(3 points)

63. Given (1 point):

64. Required (1 point):

65. Solution with final answer (1 point):

IV. Application and Synthesis. Read the instructions carefully and write your answer on the blanks provided in the answer sheet. (5 points)

66. Is there any kind of material that when inserted between parallel plate capacitors would reduce its capacitance? Explain your answer in one sentence ONLY.

67. Differentiate a closed-circuit diagram with a switch and 3 resistors (in series) with another closed circuit (in series) with switch but now without resistor in one sentence ONLY.

For items 68-70. How could one tell the direction of the magnetic force on a straight wire carrying a current by just using qualitative observations? Explain in 3-6 sentences ONLY. You can use the blanks (68-70) provided in your answer sheet for your answer. Refer to the rubrics below: (3 points)

Rubrics for Grading:
- The concepts were used accurately, with no grammatical error and with sophisticated connections with relevant concepts (3 points)

- Some concepts were used accurately, with 1-2 grammatical errors and has limited connections with relevant concepts (2 points)

- Only one concept was used accurately, with 3-5 grammatical errors and has limited to no connections with relevant concepts (1 point)

68.
69.
70.

STOP!
END OF THE THIRD QUARTER EXAMINATION

PREPARED BY:
-Sir MIKE ANGELO A. ALOBA-

ELECTRICITY AND MAGNETISM

$$\left|\vec{F}_E\right| = \frac{1}{4\pi\varepsilon_0}\left|\frac{q_1 q_2}{r^2}\right|$$

$$\vec{E} = \frac{\vec{F}_E}{q}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\varepsilon_0}$$

$$E_x = -\frac{dV}{dx}$$

$$\Delta V = -\int \vec{E} \cdot d\vec{r}$$

$$V = \frac{1}{4\pi\varepsilon_0}\sum_i \frac{q_i}{r_i}$$

$$U_E = qV = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$$

$$\Delta V = \frac{Q}{C}$$

$$C = \frac{\kappa\varepsilon_0 A}{d}$$

$$C_p = \sum_i C_i$$

$$\frac{1}{C_s} = \sum_i \frac{1}{C_i}$$

$$I = \frac{dQ}{dt}$$

$$U_C = \frac{1}{2}Q\Delta V = \frac{1}{2}C(\Delta V)^2$$

$$R = \frac{\rho \ell}{A}$$

$$\vec{E} = \rho \vec{J}$$

$$I = Nev_d A$$

$$I = \frac{\Delta V}{R}$$

$$R_s = \sum_i R_i$$

$$\frac{1}{R_p} = \sum_i \frac{1}{R_i}$$

$$P = I\Delta V$$

A = area
B = magnetic field
C = capacitance
d = distance
E = electric field
$\mathcal{E}$ = emf
F = force
I = current
J = current density
L = inductance
ℓ = length
n = number of loops of wire per unit length
N = number of charge carriers per unit volume
P = power
Q = charge
q = point charge
R = resistance
r = radius or distance
t = time
U = potential or stored energy
V = electric potential
v = velocity or speed
ρ = resistivity
Φ = flux
κ = dielectric constant

$$\vec{F}_M = q\vec{v} \times \vec{B}$$

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I$$

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{I\, d\vec{\ell} \times \hat{r}}{r^2}$$

$$\vec{F} = \int I\, d\vec{\ell} \times \vec{B}$$

$$B_s = \mu_0 nI$$

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\mathcal{E} = \oint \vec{E} \cdot d\vec{\ell} = -\frac{d\Phi_B}{dt}$$

$$\mathcal{E} = -L\frac{dI}{dt}$$

$$U_L = \frac{1}{2}LI^2$$