UOIT SECONDARY SCHOOL

Physics 12 SPH4U Unit 3Test

D1. analyse the operation of technologies that use gravitational, electric, or magnetic fields, and assess the technologies' social and environmental impact; D2. investigate, in qualitative and quantitative terms, gravitational, electric, and magnetic fields, and solve related problems; D3. demonstrate an understanding of the concepts, properties, principles, and laws related to gravitational, electric, and magnetic fields and their interactions with matter.

Name:…… Date:…… Time: 40min Max

Knowledge & Understanding	Thinking	Communication	Application
/ 15	/ 14	/ 12	/14

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. The value of *g* on Saturn is 10.9 N/kg. The weight of a 2.5-kg mass on Saturn is
   a. 2.5 kg
   b. 4.4 N
   c. 11 N
   d. 4.4 kg
   e. 27 N

____ 2. A negatively charged rod is held near, but does not touch the knob of an electroscope. The leaves of the electroscope move apart from one another. A wire is connected to the knob and to a water tap with the negatively charged rod staying in the same position. Which of the following would occur?
   a. Electrons flow from the earth through the wire to the electroscope.
   b. No electron flow takes place.
   c. The leaves of the electroscope remain still.
   d. The leaves of the electroscope move closer together.
   e. Electrons flow from the electroscope through the wire to the earth.

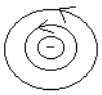
____ 3. A piece of paper becomes electrically charged when a charged rod of plastic is placed close to it. This is referred to as
   a. charging by a conductor
   b. charging by induction
   c. charging by an insulator
   d. charging by contact
   e. charging by electricity

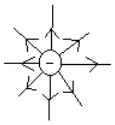
____ 4. A positively charged rod is brought close to a neutral pith ball hanging by a thread. The pith ball
   a. becomes negatively charged
   b. is repelled by the rod and the attracted to the rod
   c. becomes positively charged
   d. is attracted to the rod and then repelled by the rod
   e. remains hanging by a thread motionless and unaffected by the rod

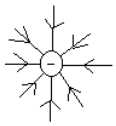
____ 5. The law of electric charges states that opposite charges
   a. attract each other, similar charges attract neutral objects, and charged objects repel one another
   b. repel each other, similar charges attract neutral objects, and charged objects attract one another
   c. attract neutral objects, similar charges repel each other, and charged objects attract one another
   d. attract each other, similar charges repel one another, and charged objects attract some neutral objects
   e. attract neutral objects, similar charges attract each other, and charged objects repel one another

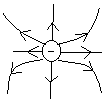
____ 6. Which of the following is NOT a similarity or difference between Coulomb's law and Newton's law of universal gravitation?
   a. The forces act along the line joining the centres of the masses or charges.
   b. The electric force can attract or repel, depending on the charges involved, whereas the gravitational force can only attract.
   c. The universal constant G is very small and in many cases the gravitational force can be ignored. Coulomb's constant k is very large, so that even small charges can result in noticeable forces.
   d. Coulomb's law is the product of two masses, whereas Newton's law of universal gravitation is the product of two charges.
   e. The size of the force is the same as the force that would be measured if all the mass or charge is concentrated at a point at the centre of the sphere.

____ 7. Which of the following diagrams represents the field of force around a negative point charge?

a. 

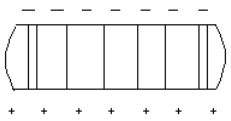
b. 

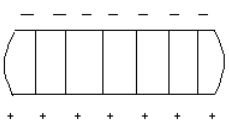
c. 

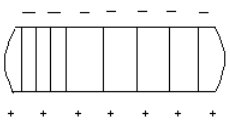
d. 

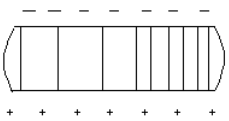
e. 

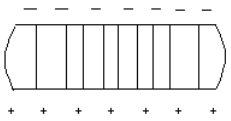
____ 8. Which of the following diagrams most accurately depicts the field between two oppositely charged plates?

a. 

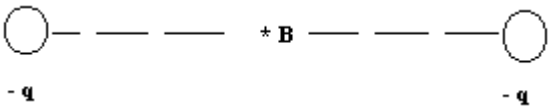
b. 

d. 

e. 

c. 

____ 9. If point charge $-q$ was absent, the electric field at point B would be E. What is the electric field between the two point charges, $-q$ and $-q$, at point B which lies at the midpoint between the two charges?

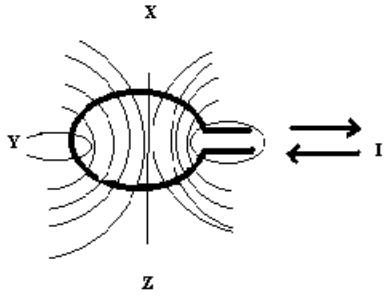


a. 2E [right]
b. 0
c. 2E [left]
d. $\frac{E}{2}$ [left]
e. $\frac{E}{2}$ [right]

____ 10. A sphere of charge $+q$ is in a fixed position. A smaller sphere $+q$ is placed near the larger sphere and released from rest. Which one of the following best describes its motion?
a. decreasing velocity and increasing acceleration
b. decreasing velocity and constant acceleration
c. increasing velocity and decreasing acceleration
d. increasing velocity and increasing acceleration
e. decreasing velocity and decreasing acceleration

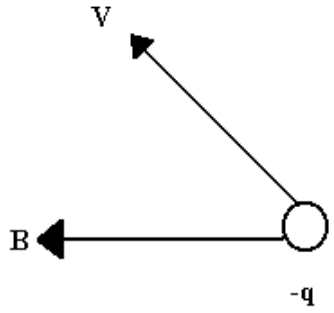
____ 11. Which of the following statements about determining the magnetic field around a straight conductor is NOT correct?
a. The thumb of your right hand that points is pointing in the direction of the current.
b. A compass may be used when it is orientated perpendicular to the conductor.
c. Grasp the conductor with your right hand.
d. Curl the fingers of your right hand in the direction of the magnetic field lines.
e. A compass may be used when it is orientated parallel to the conductor.

____ 12. Which of the following statements about the loop shown below is false? (The loop is horizontally oriented.)



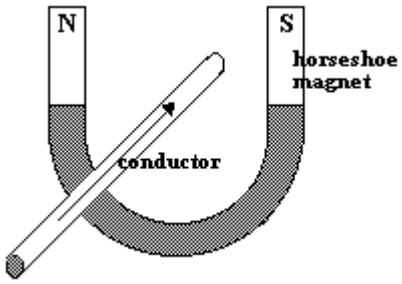
a. The north pole of the loop is at the bottom of the loop labelled Z.
b. The direction of the magnetic field cannot be determined.
c. The magnetic field goes up through the loop.
d. The magnetic field is strongest in the inside of the loop.
e. The south pole of the loop is labelled X.

____ 13. Given that in the diagram below, *B* is the magnetic field and *v* is the speed of the positive particle, what is the direction of the magnetic force?



a. right
b. out of the page
c. left
d. into the page
e. downward

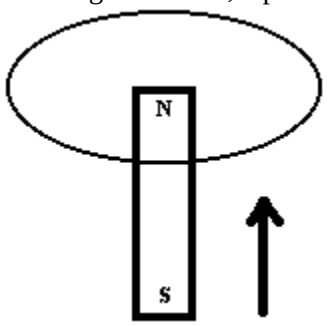
____ 14. A conductor is located between the poles of a horseshoe magnet. Current flows in the direction indicated by the arrow on the diagram.



In which direction will the conductor move?

a. upward
b. left
c. downward
d. right
e. out of the page

____ 15. In the diagram below, a permanent magnet is pulled upward through a horizontal loop of wire.



Which of the following describes the induced current as viewed from above?

a. clockwise then counterclockwise
b. clockwise
c. counterclockwise then clockwise
d. counterclockwise
e. No current is induced.

Short Answer

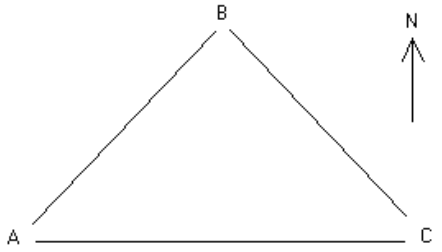
16. Explain the process of charging by induction using a positive rod, an electroscope, and a wire. Be sure to mention the movement of charges and the final charge on the electroscope. (3)

17. State the right-hand rule for determining the direction of magnetic force for a negative charge moving through a magnetic field.(3)

Problem

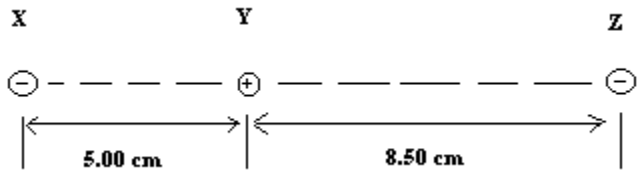
18. Calculate the value of the gravitational field strength *g*, 250 km above the surface of Earth.(3)

19. Three identical point charges A, B, and C are located as shown on the diagram. A exerts force *F* on B. An equal force *F* is exerted by C on B ($\angle ABC = 90°$). What is the net force on B?(4)



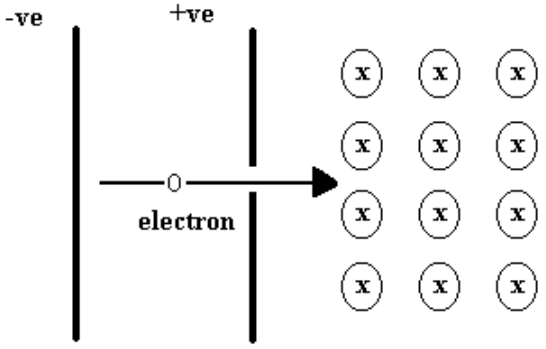
20. Two charged spheres are 2.00 m apart. One sphere has a charge of 5.70×10^{-1} C and the other sphere has a charge of 1.60×10^{-5} C. Assuming $k = 9.00 \times 10^{9}\ \mathrm{N \cdot m^2 / C^2}$, what is the electric force between the two spheres?(3)

21. Charged spheres X and Y are in a set position and have charges -2.4×10^{-3} C and $+3.3 \times 10^{-2}$ C, respectively. Calculate the net force on sphere Z, of charge -1.7×10^{-6} C.(4)



22. Draw an electric field in the region around two negative point charges close to one another.(2)

23. An electron accelerates from rest through an electric field and into a magnetic field as shown in the diagram below. The plates have a potential difference of 25 V, and the magnetic field has a magnitude of 0.50 T. (Remember: $m_e = 9.1 \times 10^{-31}$ kg and $e = 1.6 \times 10^{-19}$ C.) (6)
(a) Calculate the initial speed of the electron upon entering the magnetic field.
(b) Calculate the magnitude and direction of the magnetic force on the electron.
(c) Calculate the radius of the electron's circular path.



24. A straight wire carrying a current of 10.0 A is in proximity to another wire carrying a current of 3.0 A. If the magnitude of the force between them is 2.6×10^{-7} N/m, what is the distance between the wires?(4)