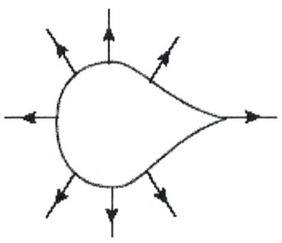
D

KEY

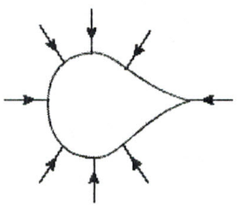
Physics 3204 Assignment
Unit 2: Fields
Student Name : _____

1. Which diagram best represents the electric field around a positively charged object?

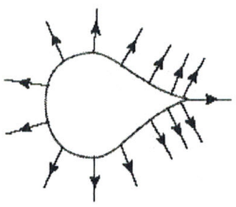
(A)



(B)



(C)



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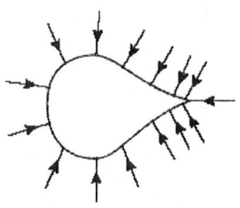
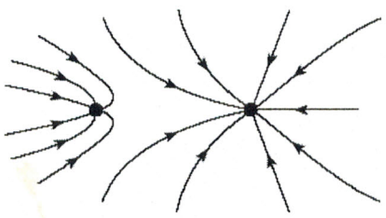


2. Which of the following is a possible electric field configuration?

A)



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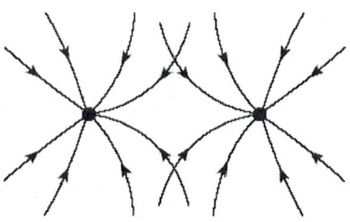

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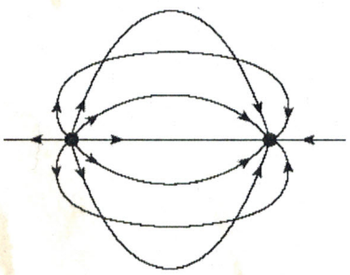

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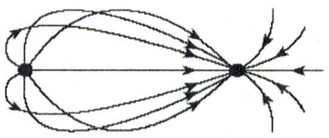
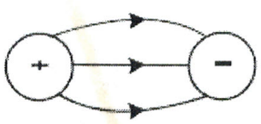


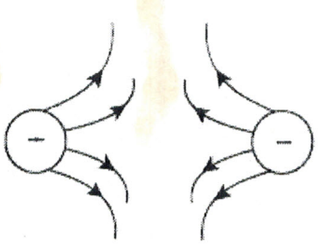
3. Which shows the electric field lines surrounding two negatively charged objects?

(A)



(B)

(C)



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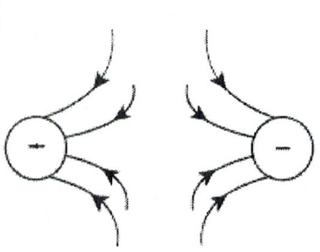
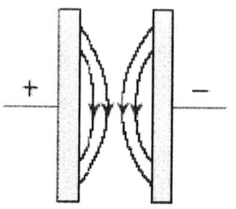


4. Which shows the electric field between two oppositely charged parallel plates?

(A)



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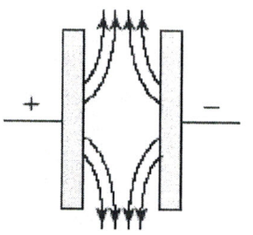

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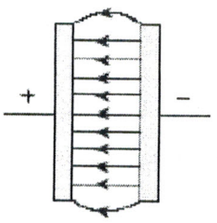

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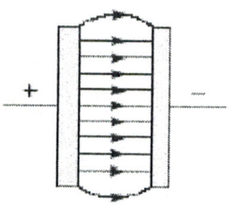
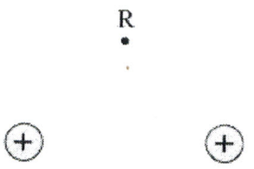


5. Two equally charged particles are placed close together as shown below.



Which of the following shows the net electric field due to these two particles at point R?

(A) 

(B) 

(C) 

(D) 

6. Which describes electric field lines?

(A) Circle clockwise around positive charges
(B) Circle counterclockwise around positive charges
(C) Directed away from negative charges
(D) Directed toward negative charges

7. What force is experienced by a 2.50×10^{-6} C test charge placed in a 2.92×10^{4} N/C electric field?

(A) 8.56×10^{-11} N
(B) 7.30×10^{-2} N
(C) 6.57×10^{8} N
(D) 1.17×10^{10} N

$F = qE$

$= (2.50 \times 10^{-6})(2.92 \times 10^{4})$

$= 7.3 \times 10^{-2}$ N

8. A Van de Graaf generator creates an electric field about a metal sphere. A 3.0 μC charge, near the sphere, experiences a force of 5.4 x 10^{-4} N. What is the strength of the electric field at the location of the charge?

(A) 1.6 x 10^{-9} N/C
(B) 5.4 x 10^{-4} N/C
(C) 8.1 x 10^{-4} N/C
(D) 1.8 x 10^{2} N/C

$\vec{E} = \frac{F_e}{q}$

$= \frac{(5.4 \times 10^{-4})}{(3.0 \times 10^{-6})}$ → = 180 N/C = 1.8×10^{2} N/C

9. What is the magnitude of the electrostatic force acting on an electron located in an electric field having a strength of 5.0 × 10^{3} N/C?

↳ formula sheet

(A) 3.1 × 10^{22}N
(B) 5.0 × 10^{3}N
(C) 8.0 × 10^{-16} N
(D) 3.2 × 10^{-23} N

$F_e = qE$

$= (1.602 \times 10^{-19})(5.0 \times 10^{3})$

$= 8.0 \times 10^{-16}$ N

10. What is the electric field strength 0.50 m away from an object having a charge of 2.5 μC?

(A) 5.0 × 10^{-6} N/C
(B) 1.0 × 10^{-5} N/C
(C) 4.5 × 10^{4} N/C
(D) 9.0 × 10^{4} N/C

$\vec{E} = \frac{kQ}{r^2}$

$= \frac{(9.0 \times 10^{9})(2.5 \times 10^{-6})}{(0.50)^2}$ → = 9.0×10^{4} N/C

11. Which of the following is defined as the energy per unit charge required to move a charged object between any two points?

(A) Electric field
(B) Electric force
(C) Electric potential energy
(D) Electric potential difference

12. How much work is done when a charge of 3.00 C moves through a drop of 15 V?

(A) 5.00 J
(B) 12.0 J
(C) 18.0 J
(D) 45.0 J

$V = \frac{W}{q}$

$W = V \cdot q$

$= (15)(3.00)$ → 45.0 J

13. A metal sphere with a charge of 4.0 x 10^{-6} C is 3.0 cm away from another sphere of charge 2.0 x 10^{-6} C. What is the electric potential energy stored between them?

(A.) 8.0 X 10^{1} J
(B) 2.4 J
(C) 8.0 X 10^{-1} J
(D) 240 J

$E_e = \frac{kQQ_2}{r}$

$= \frac{(9.0 \times 10^{9})(4.0 \times 10^{-6})(2.0 \times 10^{-6})}{(0.03)}$ → = 2.4 J

14. Calculate the electric potential difference if 320 J of work was done to move a proton in an electric field.

↳ from formula sheet

(A) 5.00 x 10^{-22} V
(B) 5.12 x 10^{-17} V
(C) 2.00 x 10^{21} V
(D) 3.20 x 10^{2} V

$V = \frac{E_e}{q}$

$= \frac{320}{1.602 \times 10^{-19}}$ → = 2.0×10^{21} V

15. If 28.6 joules of work is done in moving 5.0 coulombs of charge against a uniform electric field what is the potential difference between the positions?

(A) 0.17 V
(B) 5.7 V
(C) 28.6 J
(D) 140 V

$V = \frac{E}{q} = \frac{28.6}{5.0} = 5.7$ V

16. A 0.16 C charge is moved in an electric field from a point with a potential of 25 V to another point with a potential of 95 V. How much work was done to move this charge?

(A) 4.0 J
(B) 11 J
(C) 15 J
(D) 19 J

$\Delta V = V_2 - V_1$
$= 95 - 25$
$= 70\ V$

$\Delta E_e = \Delta V q$
$\Delta E_e = (70)(0.16)$
$= 11\ J$

17. How much work is done by a 6.0 V battery to transfer 6.0×10^2 C of charge to a circuit?

(A) 3.6×10^{-3} J
(B) 1.0×10^{-2} J
(C) 1.0×10^2 J
(D) 3.6×10^3 J

$V = \frac{W}{q}$
$W = Vq$
$= (6.0)(6.0 \times 10^2)$
$= 3.6 \times 10^3\ J$

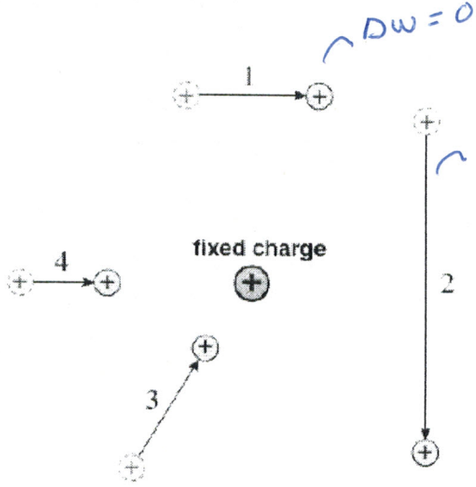
18. What is the potential difference between two points if 5.0 kJ of work is done to move 2.0 C of charge between the points?

(A) 10.0 V
(B) 2.5 kV
(C) 10.0 kV
(D) 10.0 MV

$V = \frac{W}{q}$
$= \frac{5.0 \times 10^3}{2.0}$
$= 2.5 \times 10^3\ V$
$= 2.5\ kV$

19. A small sphere with an electric charge may be moved in four different ways near a fixed electric charge. Which displacement requires the most work?

(A) 1
(B) 2
(C) 3
(D) 4



$\Delta W = 0$ moved parallel to charge.
$\Delta W = 0$

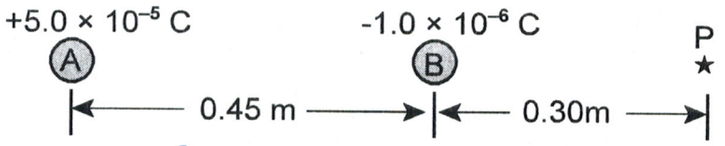
20. An electron gains 1.36 x 10 -18 J of electric potential energy as it is moved in an electric field. How much electric potential does the electron gain?

(A) 1.6×10^{-19} V
(B) 1.4×10^{-18} V
(C) 1.4 V
(D) 8.5 V

formula sheet

$V = \frac{W}{q}$
$= \frac{(1.36 \times 10^{-18})}{(1.602 \times 10^{-19})}$
$= 8.5\ V$

21. Calculate the net electric field at point P in the diagram shown. **[5]**



$\vec{E}_A = \frac{kQ_A}{r_A^2}$

$= \frac{(9.0 \times 10^9)(5.0 \times 10^{-5})}{(0.75)^2}$

$= 8.0 \times 10^5 N/C$

$\vec{E}_B = \frac{kQ_B}{r_B^2}$

$= \frac{(9.0 \times 10^9)(-1.0 \times 10^{-6})}{(.30)^2}$

$= 1.0 \times 10^5 N/C$

$\vec{E}_{Net} = \vec{E}_A + \vec{E}_B$

$= (+8.0 \times 10^5) + (-1.0 \times 10^5)$

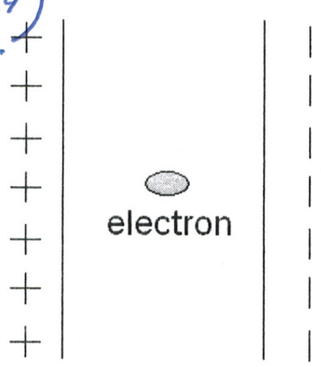
$= 7.0 \times 10^5 N/C$ [Right]

23. An electron is placed between two oppositely charged parallel plates with an electric field strength of 2.7×10^4 N/C and accelerates horizontally toward one of the plates. Calculate the acceleration of the electron. **[5]**

$\vec{a} = \frac{F_{Net}}{m}$ ~ $F_e = q\vec{E}$

$= (1.602 \times 10^{-19})(2.7 \times 10^4)$

$= 4.32 \times 10^{-15} N$



$= \frac{F_e}{m_e}$ (formula sheet)

$= \frac{4.32 \times 10^{-15}}{9.11 \times 10^{-31}}$

$= 4.74 \times 10^{15} m/s^2$

24. The work done on a test charge of magnitude $q = +1.0 \times 10^{-6}$ C in moving it a distance against an electric field is 5.0×10^{-5} J.

A) What is the change in electric potential energy of the charge for this displacement? [1]

$\Delta E = \text{Work} = 5.0 \times 10^{-5}\ J$

B) What is the potential difference between these two positions? [2]

$\Delta V = \frac{\Delta E}{q}$

$= \frac{5.0 \times 10^{-5}\ J}{1.0 \times 10^{-6}\ C}$

$= 50\ V$

25. A positive test charge of 1.5×10^{-6} C is placed in an electric field 10 cm from another charge of magnitude -5.0×10^{-6} C that is anchored in place.

A) What is the electric potential energy of the test charge? [2]

$q = 1.5 \times 10^{-6}\ C$

$Q = 5.0 \times 10^{-6}\ C$

$r = 10\ cm = .10\ m$

$E = ?$

$E = \frac{kqQ}{r}$

$= \frac{(9.0 \times 10^9)(1.5 \times 10^{-6})(5.0 \times 10^{-6})}{(.10)}$

$= .675\ J$

B) What is the electric potential 10 cm away from the negative charge? [2]

$Q = 5.0 \times 10^{-6}\ C$

$r = 10\ cm = .10\ m$

$V = ?$

$V_1 = \frac{kQ}{r}$

$= \frac{(9.0 \times 10^9)(5.0 \times 10^{-6})}{(.10)}$

$V_1 = 450\,000$

$V_1 = 4.5 \times 10^5\ V$

C) What is the potential difference between the test charge's initial position and a position 5.0 cm closer to the negative charge? [3]

$Q = 5.0 \times 10^{-6}\ C$

$r = 10\ cm - 5\ cm = 5\ cm$

$= 0.05\ m$

$V = ?$

$V_2 = \frac{kQ}{r}$

$= \frac{(9.0 \times 10^9)(5.0 \times 10^{-6})}{(.05)}$

$= 900\,000\ V$

$= 9.0 \times 10^5\ V$

$\Delta V = V_2 - V_1$

$\Delta V = (9.0 \times 10^5) - (4.5 \times 10^5)$

$\Delta V = 4.5 \times 10^5\ V$