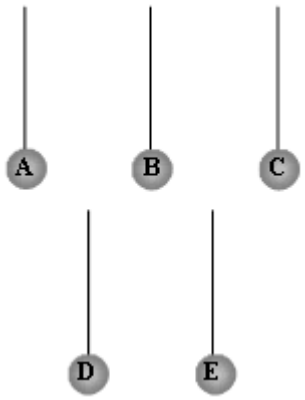
NAME: KEY **KP UiTM:**_____

Program: _____

QUIZ 1 July 3rd 2006

Answer ALL questions on the question paper. DO NOT use additional paper.

1. Five styrofoam balls are suspended from insulating threads. Several experiments are performed on the balls; and the following observations are made:



Ball A attracts B and A repels C.
Ball D attracts B and D has no effect on E.
A negatively charged rod attracts both A and E.

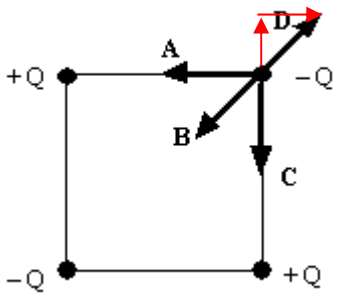
What are the charges, if any, on each ball?

	A	B	C	D	E
A)	+	-	+	0	+
B)	+	-	+	+	0
C)	+	-	+	0	0
D)	-	+	-	0	0
E)	+	0	-	+	0

2. Each of three objects has a net charge. Objects A and B **attract** one another. Objects B and C also attract one another, but objects A and C **repel** one another. Which one of the following table entries is a possible combination of the signs of the net charges on these three objects?

	A	B	C
A)	+	+	-
B)	-	+	+
C)	+	-	-
D)	-	+	-
E)	-	-	+

3. Four point charges, each of the same magnitude, with varying signs are arranged at the corners of a square as shown. Which of the arrows labeled A, B, C, and D gives the correct direction of the net force that acts on the charge at the upper right corner?

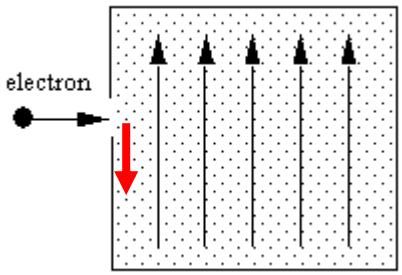


A) **A**
B) **B**
C) **C**
D) **D**
E) The net force on that charge is zero.

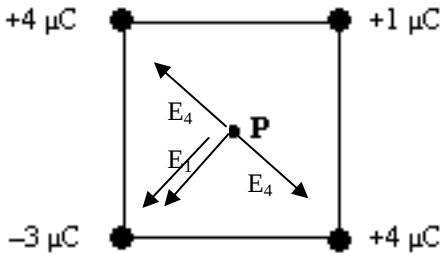
4. Which one of the following statements is true concerning the magnitude of the electric field at a point in space?

A) It is a measure of the total charge on the object.
B) It is a measure of the electric force on any charged object.
C) It is a measure of the ratio of the charge on an object to its mass.
D) It is a measure of the electric force per unit mass on a test charge.
E) It is a measure of the electric force per unit charge on a test charge.

5. An electron traveling horizontally enters a region where a uniform electric field is directed upward. Show the direction of the force exerted on the electron once it has entered the field?



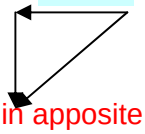
6. Four point charges are placed at the corners of a square as shown in the figure. Each side of the square has length 2.0 m.



a. Draw the electric fields for each of the charges at point P, the center of the square.

b. Obtain the distances from point P to each of the charges.

Use Pythagoras theorem: $r^2 = a^2 + b^2$. So, $r^2 = 1^2 + 1^2 = 2$. Then $r = \sqrt{2}$.



c. Determine the magnitude of the net electric field at the point P

Since $E = \frac{kq}{r^2}$, then $E_1 = \frac{k}{2}$, $E_3 = \frac{k3}{2}$, $E_4 = \frac{k4}{2}$. Since E4 are in apposite directions, they cancel off. Then find x components of E_1 & E_3 and the y components of E_1 & E_3

$$E_x = -E_{1x} - E_{3x} = -\frac{k1}{2}\cos 45 - \frac{k3}{2}\cos 45 = -\frac{k1}{2}\frac{1}{\sqrt{2}} - \frac{k3}{2}\frac{1}{\sqrt{2}} = -\frac{k4}{2\sqrt{2}}$$ and

$$E_y = -E_{1y} - E_{3y} = -\frac{k1}{2}\sin 45 - \frac{k3}{2}\sin 45 = -\frac{k1}{2}\frac{1}{\sqrt{2}} - \frac{k3}{2}\frac{1}{\sqrt{2}} = -\frac{k4}{2\sqrt{2}}$$

$$E = \sqrt{E_x^{\,2} + E_y^{\,2}} = \sqrt{\left(\frac{k4}{2\sqrt{2}}\right)^2 + \left(\frac{k4}{2\sqrt{2}}\right)^2} = \frac{k4}{2\sqrt{2}}\sqrt{32} = \frac{k4}{2\sqrt{2}}\sqrt{4x4x2} = 4k$$

$$\tan\theta = \frac{E_y}{E_x} = 1$$ So $\theta = 45^\circ$

d. If a charge of 1 μC is placed at P, explain what happens to this charge.

The charge will accelerate in the direction of E, southwest corner of the square with acceleration $a = \frac{F}{m} = \frac{qE}{m} = \frac{2k}{m}$

(4+4+24+2 = 34 marks)