**CW 13.9 – Wacky Squares Name: ……………………………………..**



The square of side *a* above contains a positive point charge *+Q* fixed at the lower left corner and negative point charges *–Q* fixed at the other three corners of the square. Point P is located at the center of the square.

1. On the diagram, indicate with an arrow the direction of the net electric field at point P. (1)
2. Derive expressions for each of the following in terms of the given quantities and fundamental constants.
3. The magnitude of the electric field at point P (2)
4. The electric potential at point P (2)
5. A positive charge is placed at point P. It is then moved from point P to point R, which is at the midpoint of the bottom side of the square. As the charge is moved, is the work done on it by the electric field positive, negative, or zero? (2)

 \_\_\_\_Positive \_\_\_\_Negative \_\_\_\_Zero

 Explain your reasoning.

1. Describe one way to replace a single charge in this configuration that would make the electric field at the center of the square equal to zero. Justify your answer. (2)

1. Describe one way to replace a single charge in this configuration such that the electric potential at the center of the square is zero but the electric field is not zero. Justify your answer. (2)