PHYS102 - Potential Energy and Electric Potential.

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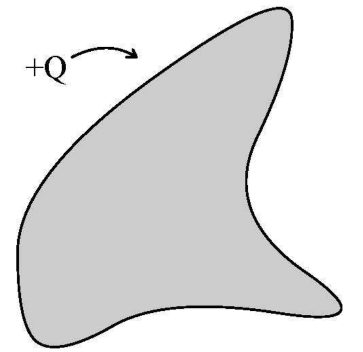
Question #1

A net charge +Q is deposited on an irregularly shaped conductor as shown below. The conductor is allowed to reach equilibrium. What conclusion can be drawn about the electric field at the surface of the conductor?



1. The electric field at the surface of the conductor is zero for every point along the conductor.
2. There is a component of the electric field parallel to the conductor's surface at every point along the conductor.
3. The electric field must be perpendicular to the conductor's surface at every point along the conductor.

Answer to question #1

1. Since the conductor is in equilibrium, the electric field CANNOT have a component parallel to the surface of the conductor.

PRS Questions

Answer to question #1

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2. The conductor is charged so it possess an electric field at its surface.

Answer to question #1

1. Since the conductor is in equilibrium, the electric field CANNOT have a component parallel to the surface of the conductor.If there existed a component of the electric field parallel to the conductor's surface, then the conductor would not be in equilibrium.

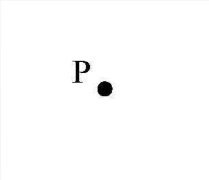
2. The conductor is charged so it possess an electric field at its surface.

3. Answer is 3.

PRS Questions

Question #2

A charged particle (+q) is moved from infinity to the location denoted P in the figure below. There are no other charges or electric fields present. How much work is required to bring this particle to point P?



1. Zero.
2. Infinite.
3. I can't answer the question because I need more information.

Answer to question #2

1. There are no fields so there are no forces acting on the charged particle.

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2. No forces

Answer to question #2

PRS Questions

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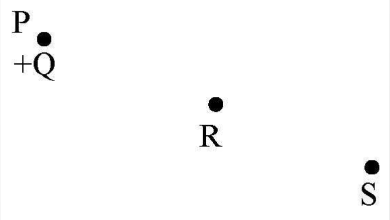
2. No forces $\longrightarrow$ NO WORK DONE.

Answer to question #2

1. There are no fields so there are no forces acting on the charged particle.
2. No forces $\longrightarrow$ NO WORK DONE.
3. Answer is 1.

Question #3

A charged particle +Q is located at position P in space. A second charged particle (+q) is moved from point R to point S in the figure below. There are no other fields present. The work required to move q from R to S is



1. Zero.
2. Infinite.
3. Positive.
4. Negative.

Answer to question #3

1. At point R, $+q$ experiences a repulsive force.

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2. Forces through a distance

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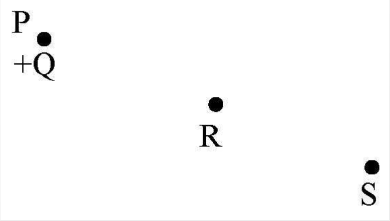
Answer to question #3

1. At point R, $+q$ experiences a repulsive force.
2. Forces through a distance $\longrightarrow$ WORK.
3. $+q$ wants to move (accelerate) naturally from R to S so an external agent would have to apply a force in a direction *opposite* to the particle's motion.
4. Answer is 4.

Question #4

A charged particle +Q is located at position P in space. A second charged particle (-q) is moved from point R to point S in the figure below. There are no other fields present. The work required to move -q from R to S is



1. Zero.
2. Infinite.
3. Positive.
4. Negative.

Answer to question #4

1. At point R, $-q$ experiences an attractive force.

Answer to question #4

1. At point R, $-q$ experiences an attractive force.
2. Forces through a distance

Answer to question #4

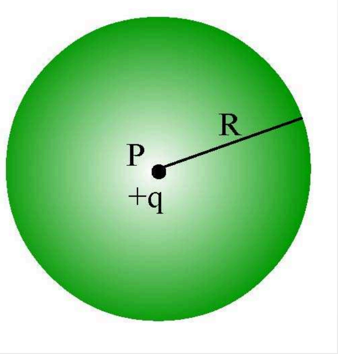
1. At point R, $-q$ experiences an attractive force.
2. Forces through a distance $\longrightarrow$ WORK.

Answer to question #4

1. At point R, $-q$ experiences an attractive force.
2. Forces through a distance $\longrightarrow$ WORK.
3. $-q$ wants to move (accelerate) toward Q. An external agent would have to apply a force in the direction of displacement.
4. Answer is 3.

Question #5

A charged particle (+q) is located at point P in the figure below. There are no other charges or electric fields present. How much work is required to move a charge +Q around a sphere of radius R concentric with point P?



1. Zero.
2. Infinite.
3. I can't answer the question because I need more information.

Answer to question #5

1. At point R, $+Q$ experiences an force directed along a line connecting the two charges.

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1. At point R, $+Q$ experiences an force directed along a line connecting the two charges.
2. The displacement of $+Q$ is perpendicular to the electric field (and hence force) generated by $+q$.

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$$W = \int \vec{\mathbf{F}} \cdot d\vec{\mathbf{l}}$$
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$$W = 0.$$

4. Answer is 1.

   NOTE: Surfaces in which moving a charged particle requires no work are called "equipotential" surfaces.