What is Gauss's Law?

Worksheet

Gauss's law states that the net electric flux through a closed surface equals the enclosed charge divided by the permittivity of free space: _E = Q_enc/.

$$\oint \vec{E}\ d\vec{A} = \frac{Q_{enc}}{\epsilon_0}$$

Questions

1. A closed surface encloses 10 nC of charge. Approximately what is the flux?

A) ~1.110 Nm/C
B) ~8.85410 Nm/C
C) ~10 Nm/C
D) ~0 Nm/C

2. What does Gauss's law say the flux depends on?

A) Surface shape only
B) Enclosed charge only
C) Surface area only
D) Distance to nearest charge

3. A closed surface encloses equal positive and negative charges. Net flux is:

A) Maximum
B) Negative infinity
C) Zero
D) Undefined

4. Gauss's law is most useful for finding electric fields when:

A) The charge distribution has symmetry
B) The charges are moving
C) There's no charge at all
D) The surface is irregular

5. A closed sphere encloses a charge of 2 nC (210 C). Find the electric flux through the surface.

6. A closed surface encloses a charge of 5 C. Find the flux.

7. A closed box contains two charges: +4 nC and 4 nC. Find the net electric flux through the box.

8. Define: What is Gauss's law?

9. Define: What is ?

10. Define: Does the shape of the closed surface matter?

Answer Key

1. A) ~1.110 Nm/C - _E = Q/ = 1010/8.85410 1129 Nm/C.

2. B) Enclosed charge only - Only the total enclosed charge determines the net flux, regardless of surface shape or size.

3. C) Zero - Q_enc = 0, so _E = 0/ = 0.

4. A) The charge distribution has symmetry - Symmetric charge distributions (spherical, cylindrical, planar) let you pull E out of the flux integral easily.

5. _E = Q_enc / _E = 210 / 8.85410 _E 225.9 Nm/C

6. _E = Q_enc / _E = 510 / 8.85410 _E 5.6510 Nm/C

7. Q_enc = (+4 nC) + (4 nC) = 0 _E = Q_enc / = 0 / _E = 0 Nm/C

8. _E = Q_enc/ - the net electric flux through a closed surface equals enclosed charge divided by .

9. The permittivity of free space, 8.85410 C/(Nm), a fundamental constant.

10. No - only the total enclosed charge matters, not the surface's shape or size.