Can there be a non-zero electric field at an isolated position (i.e., a single point) in space even if there is no electric charge there? How could that be possible? Can there be a charge at an isolated position in space where the field is zero? Discuss thoroughly.

Electric fields represent an interaction waiting to happen

Yes, it is possible because electric fields extend infinitely. An electric charge from somewhere else will cause an electric field in the isolated position. No, if there's a charge then there must be a nonzero electric field because charges produce nonzero electric fields.

...There can be a charge at an isolated position in space, the intersection between charges equal in magnitude and opposite in charge will form the field of zero these will cancel to cause the field of zero

There can be a non-zero electric field at an isolated position in space even if there is no electric charge there. An electric field represents a possible electric force that could happen and the force per charge there. There cannot be a charge at an isolated position in space where the field is zero because the field represents that charge.

Good discussion

If I understand correctly, yes
An electric field represents a hypothetical interaction that could occur at a given position in space between two charges. The effect of the one charge need not be at the specified isolated position. The electric field given off by the nearest charged particle is mathematically everywhere so it doesn't even have to be close. Additionally, the second charge that would interact with the first, doesn't even need to exist as long as we can imagine that is it there at the isolated point.

According to the primary definition of an electric field:

$$E = F/q$$

The electric field doesn't require a real charged particle at any given place

An old fashioned (non-flat screen!) television tube works by accelerating electrons (m = 9.11 *10^-31 kg, q = 1.6 * 10^-19 C) using an electric field and firing them toward a phosphorescent screen. They actually hit the screen moving at about one quarter of the speed of light! (The speed of light is 3 * 10^8 m/s). Calculate (using reasonable estimates for the input quantities) the electric field, assuming it provides a uniform acceleration over the entire distance.

Just use kinematics

For this problem, it would make sense to go back to one of our kinematic relationships for acceleration. We have:

Vf= 7.5 x 10^7 m/s,
m= 9.11 x 10^-31 kg,
q= 1.6 x 10^-19 C, and I would assume that Vi is 0.

We need a distance, so let's assign it to be 5 cm. Now, we can go back to an equation from physics 1 which is Vf^2 = Vi^2 + 2ad. Solving for acceleration, we have:
(7.5 x 10^7 m/s)^2 / 2(0.05 m) ~ 5 x 10^16 m/s^2.

(dp: do algebra first!   a = Vf^2/2d = (7.5 x 10^7 m/s)^2 / 2(0.05 m) ~ 5 x 10^16 m/s^2)

Now, we need the force so use F=ma=(9.11 x 10^-31 kg)(5 x 10^16 m/s^2) ~ 50 x 10^-15N.
Finally, We can find the electric field using
E = F/q = (50 x 10^-15N)/(1.6 x 10^-19C) ~30 x 10^4 N/C.

Another example with correct logic but that doesn't include units consistently

electric field is equal to the force per charge

Force is found from the kinetic energy of the electrons divided by the distance the electrons travel because ke = work = Fd
ke = mv^2

I'm estimative the electrons move 0.5 mm (0.0005 meters)

9x10^-31 * (3x10^8)^2
9x10^-31 * 9x10^10 =81x10^-21 kg*m^2/s^2

convert to force by dividing by distance

(8.1x10^-20 kg*m^2/s^2) / (0.5mm) * (1000mm/1m) = F
~1.60x10-19 kg*m^2/s^2*mm * (1000mm/1m) = 1.6x10^-16 kg*m/s^2 = Newtons

calculating the electric field

E = F/q

E = 1.6x10^-16 N / 1.5x10-19 = ~1x10^3 = 1000 N/C

The electric field lines from a lone charge look most like a

a. Sea squirt
b. Sea urchin
c. Sea horse
d. Sea gull