**Physics: Unit Review 4**

**Part One**

Gravitational field: a gravitational field is a region around an object of mass within which a force would be exerted on other objects of mass (the equation used to generally model a said gravitational field is stated as followed (it must be well noted that the Fg equation can be manipulated to bring about an equation that finds the value of the gravitational field strength at a certain location relative to some source of mass (the equation used to calculate g is stated as followed: g = GM / r2)): Fg = Gm1m2 / r2 or Fg = GmM / r2 (where, in most cases, M = 5.98 x 1024 kg (earth’s mass), and G = 6.67 x 10-11 Nm2 / kg2))

Satellite: a satellite is an object that moves around a larger object (there are 2 main types of satellites and they’re stated as followed in accordance with their respective descriptions: the first type of satellite to deal with deals with objects that are characterized as natural-type satellites (some examples of this type of satellite are stated as followed: the earth, the moon), the second type of satellite to deal with deals with objects that are characterized as artificial-type satellites (an example of this type of satellite is that of the ISS))

Kepler’s three laws of planetary motion: kepler’s 3 laws of planetary motion are stated as followed: kepler’s first law of planetary motion goes on to postulate that each planet moves around the sun in an orbit shaped like an ellipse with the sun is at one focus of the ellipse (at this said level of physics, it must be well noted that we’ll only really be dealing with perfectly circular orbits and nothing more than that of perfectly circular orbits (and so the equation Fradialnet = ma can be dealt with when dealing with calculations involving planets orbiting the said sun (using this said equation the radial velocity equation can be derived (this said equation is stated as followed: v = √(GM/r))))), kepler’s second law of planetary motion goes on to say that the straight line joining a planet and the sun sweeps out equal areas in space in equal intervals of time (to put it quite simply, this law goes on to say that a planet travels fastest closest to the sun (or one of the said focal points) and travels slowest away from the sun), kepler’s third law goes on to postulate that the cube of the average radius of a planet’s orbit is directly proportional to the square of the period of the planet’s orbit (the equation used to model this law is stated as followed: C = r3 / T2 = Gm / 4πr2 (where C is kepler’s constant (unlike other constant, C varies accordingly from situation to situation and must be calculated with the already stated equation)))

**Part Two**

Coulomb’s law: coulomb’s law is stated as followed (at this said level of physics, it must be well noted that we’ll only really be dealing with point charges and nothing more when dealing with this said law): the electric force between two point charges is inversely proportional to the square of the distance between the charges and directly proportional to the product of the charges (mathematically speaking, the equation for coulomb’s law is stated as followed: FE = kq1q2 / r2 or FE = kq1qT / r2 (where k is 8.99 x 109 Nm2 / C2 and q1, q2 and qT are always positive in value because the equation only really calculates the magnitude of the given force and does not incorporate said direction (direction will be articulated upon later but for now one should just not take it into account)))

Similarities and differences between the electric force and the gravitational force: there are many similarities between the said electric force and the said gravitational force that must be well noted (some of these similarities are stated as followed: both the electric force and the gravitational force describe the interaction between two said objects, both the electric force and the gravitational force are non-contact forces, both forces abide an inverse-square relationship and ultimately become greater in value when either the product of their charges increase or the product of their masses said increase (it all really depends on the force dealt with at hand)), there are also many differences between the said electric force and the said gravitational force that must be well noted (some of these differences are stated as followed: it must be well noted that gravitational forces can only be said attractive-like whereas in contrast to that of said electric forces they can be either attractive-like or repulsive-like (depending upon the charges dealt with at hand, it all really varies), in addition to this it must be noted that the magnitude of the electric force is much greater than the magnitude of the gravitational force over the same distance (this is notably because the constants (the universal gravitational constant being very small in value and the said electric force constant being very big in value) dealt with multiply with the said respective charges and said masses to make it so that the electric force’s said magnitude is greater in value in comparison to that of the gravitational force’s magnitude))

**Part Three**

Electric field: an electric field is a region around a charged particle or object within which a force would be exerted on other charged particles or objects (it must be well noted that the electric field has both magnitude and direction and is expressed through the said variable Ɛ which is noted as epsilon; it must also be well noted that there is another equation used to calculate the magnitude of the electric force and it is stated as followed in accordance with the electric field intensity variable Ɛ: FE = qTƐ (note that the equation Ɛ = kq1 / r2 can be derived by expanding FE to kq1qT / r2 and by equating it to qTƐ and said solving for Ɛ); in addition to the latter, it must also be well noted that the direction of the electric field by convention points away from positive source charges and points towards negative source charges (this is so because the test charge dealt with is positive by convention and thereby follows the nature of the electric field’s direction by notably repelling from positive charges and attracting to negative ones (in some circumstances however, a negative test charge is dealt with and so one must be very cautious about how he or she deals with a given situation because then in theory all things articulated upon would be of the opposite conjecture or noting)))

Cool things to know about electric fields: some cool things to know about electric fields are stated as followed: the first cool thing to know about electric fields deals with the electric field of earth’s atmosphere created by opposite charges (a somewhat permanent positive charge has been formulated in the upper atmosphere by incoming energy from the sun and a somewhat permanent negative charge has been formulated on earth’s surface by incoming electron debris from the said upper surface), another cool thing to know about electric fields deals with the electric fields evident within that of animals (some animals (mainly types of fish) thrive solely upon electric fields to survive in nature and so they use their said respective electric fields to do just this)

**Part Four**

Some key concepts that should be well noted when one is dealing with non-uniform electric fields and said uniform electric fields: there are many things to note when one is dealing with non-uniform electric fields (some key concepts that should be well noted when one is dealing with non-uniform electric fields are stated as followed: it must firstly be well noted that the electric field lines of 2 said opposing electrically charged point charges (note that this type of charge configuration is denoted as an electric dipole) direct themselves from the said positive point charge and into the said negative point charge (if the charges are of equal magnitude then the visual is pretty clean-like in the way it have the same amount of electric field lines directed outwards and inwards to that of the respective point charges but if the charges are not of equal magnitude then the visual is more complex-like but still follows the same premise (when one is dealing with this type of visual, it must be well noted that the electric field lines of a point charge are proportional in representation to that of its said magnitude and that this premise must be used all the way throughout when one is dealing with these types of complicated electric field scenarios)), in addition to the latter it must also be well noted that the electric field lines of two said equivalently charged point charges direct themselves away from each point charge (conclusively making a somewhat crazy-like visual that shows electric field lines going away from both charges thereby making it so that the midpoint between the 2 charges consists of no electric field line (so ultimately a field line of 0 N/C in value))), there are also many things to note when one is dealing with uniform electric fields (the only real key concept that should be well noted when one is dealing with a uniform electric field is that the electric field strength within that of a said uniform electric field is very must so the same value in all given locations within that of the said electric field (this is very much so unalike the premise that non-uniform electric fields abide where the said electric field strength is strongest when closest to a said source charge and weakest when away))

The work done by the electric force upon that of a point charge in a said given uniform electric field: the work done by the electric force upon that of a positive point charge in a given uniform electric field is denoted positive in value when the point charge is moving in the direction of the electric field and is denoted negative in value when the point charge is moving in the direction opposite to that of the electric field (one must come to note that this concept has been already articulated upon and was articulated upon in the last said unit; it must also be well noted that although the concept of electric potential energy is important, the change in electric potential energy is far more important than that of the latter (the general equation used to calculate the change in electric potential energy in terms of work and the change in kinetic energy is stated as followed: -W = ΔEE = -ΔEK (note that ΔEE = -ΔEK can also be written as -ΔEE = ΔEK to better mathematically model the scenario where the loss in kinetic energy is equal to the gain in electric potential energy; it must also be well noted that work is defined negative because in all given situations of said scenario dealing with a given point charge the electric field will always be doing negative work upon that of an object (remember, when one says that work is negative, one is note saying electric potential energy is negative just that of the change in electric potential energy is negative)))))

The equation used to calculate the electric potential energy in a system of two charges at a specific location (dealing mainly with non-uniform electric fields): the equation used to calculate the electric potential energy in a system of two charges at a specific location is stated as followed (it hasn’t really been dealt with in this unit but knowing the equation might prove to be beneficial some time later in perhaps one of the homework question): EE = kq1q2 / r2 (it must be well noted that the variable q in all given equations dealing with energy can be either positive or negative depending upon that specific point charge’s said charge (this is very much so different in theory because all equations dealing with q up to this point have been always by convention positive in nature and have never been denoted as negative (but for the sake of it all, negative said signs will now be dealt with)))

Electric potential: electric potential is a measure of how much electric potential energy is associated with a specific quantity of charge at a particular location in either a uniform electric field or said non-uniform electric field

(mathematically speaking, the equation for electric potential is stated as followed: V = EE / q (where q refers to one of the said point charges and V is measured in volts (V) and is sometimes referred to as voltage (it must be well noted that this equation can be used to derive an even more so important equation: the electric potential difference equation (the equation is stated as followed: ΔV = ΔEE / q (note that this equation can be expanded upon and can be rewritten as Ɛ = -ΔV / Δd (where the negative in most cases is to be ignored or not really dealt with))))))

**Part Five**

Cool things to know about the electron: some cool things to know about the electron are stated as followed: the first cool thing to note about the electron is that the electron was discovered by a british physicist named J.J. Thompson and was discovered some 20 years before the said proton, another cool thing to note about the electron is that the charge of an electron takes on the said value -1.6 x 10-19 C (this charge is denoted as the elementary charge and is equal in magnitude to that of the charge of the proton (the only difference with the proton is that its sign is different)) and that the said mass of an electron takes on the said value 9.1 x 10-31 kg (this is very much so different to that of the mass of a proton, where a proton is measured to be 1.7 x 10-27 kg, not 9.1 x 10-31 kg (it must be well noted that the proton is actually much, much more complicated in it that it is merely just the sum of even smaller particles denoted as quarks (the electron is not as complicated in it that it is merely the simplest said thing out there known to date)))

How the magnitude of the elementary charge (the charge of an electron) was found: the magnitude of the elementary charge was found a little bit later after J.J. Thompson and was founded by a physicist named Millikan through his said famous oil drop experiment (the oil drop experiment’s main premise was to charge oil droplets via friction and then have those said oil droplet displaced in a box of some sort that consisted of two layers of charged plates (these said charged plates repelled the incoming droplets such that the force of gravity was equal in magnitude but in opposite in direction to that of the electric force of repulsion to make it so that the droplets merely floated stationary above the said surface of the box (having the object merely float stationary above a somewhat uniform electric field, he then calculated the overall charge of the droplet by using the equation Fg = FE and conclusively figured out the said value of the elementary charge by merely noting that all given calculations that he did were of approximate integer multiples of some more so fundamental value (he conclusively figured out the said elementary charge value through simple algebra and published his findings))))

**Part Six**

Some things to know about magnetic fields: some things to know about magnetic fields are stated as followed: the first thing to note about magnetic fields is that the magnetic field lines of a said bar magnet are very similar in nature to that of the electric field lines of an electric dipole configuration (this configuration is only very much alike to that of a typical bar magnet’s magnetic field only if the bar magnet’s said magnetic field lines come out of the north said pole (or the said positive charge of the electric dipole) and into the said south said pole (or the said negative charge of the electric dipole)), another thing to note about magnetic fields is that the largest magnetic field on earth is earth itself (it must be well noted that earth’s magnetic north pole is actually its said geographical south pole and its said magnetic south pole is actually its said geographical north pole (it must also be noted that these poles are not fixed and are continuously moving from time to time (scientists theorize that the molten liquid deep within that of earth’s core is causing this pole movement and is conclusively doing so in the way it said circulates from place to place deep within that of earth’s core)))

The principle of electromagnetism: the principle of electromagnetism is stated as followed: moving electric charges produce a magnetic field (it must be well noted that one can determine the direction of the magnitude of the magnetic field lines around a straight wire by using the right-hand rule for a straight conductor; it must also be well noted that a solenoid is a conducting wire wound into a coil (the magnetic field of a solenoid is strongest inside the coil because the field lines are closer together (it is important to note that the more tightly wound up the solenoid is, the straighter and closer the field lines become inside of the said coil making it so that the said magnetic field is very much so even stronger in the said coil when wound up)))