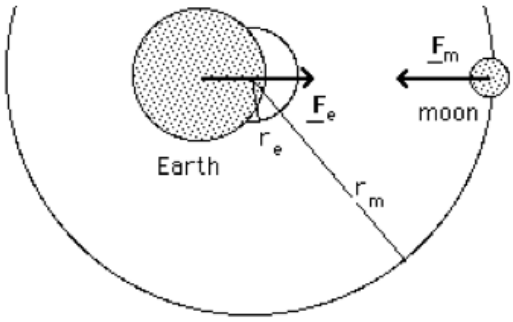
06 Fields and forces review questions

Part A: Gravitational

1. Calculate the average force of attraction between the Earth and the moon. [$M_e = 6.0 \times 10^{24}$ kg, mm = 7.3×10^{22}kg, Average distance from the Earth to the Moon is 3.8×10^{8}m.
2. Derive the formula for gravitational field strength at a planet based on all the mas being concentrated at the centre of the planet.
3. Calculate the gravitational field strength at the surface of the moon (diameter 3500km).
4. Calculate the gravitational field strength due to the moon and the Earth at a point 3.8×10^{7}m from the moon in a direction directly towards the Earth.



Part B: Electric:

1. The positive parts of the molecules of most solids cannot be transferred when rubbed with a cloth. Explain how it is possible for a material to become positively charged. What charge will the cloth have in this case?
2. The dome of a Van de Graaf generator contains 10x1025 atoms. It is made from Iron (atomic number = 26) and is charged with a negative charge of 10 coulombs.
    a. How many electrons would be transferred if the dome was discharged?
    b. What is this as a percentage of the total electrons on the dome.
    c. The dome is almost spherical and charge is added from the inside of the dome by a belt that runs through the base of the dome. Explain why the electrons already on the dome do not prevent more electrons being transferred.

3. State Coulombs law and apply it to this situation:
Two paint droplets are both charged with +5mC. If they are 1mm apart what force is acting between them?
4. Electric field strength can be given in Vm^{-1} or NC^{-1}. Using the definition of voltage and work done show that these units are equivalent.
5. Electrical potential difference is defined as the work done per unit charge in moving a charge between two points in an electric field. If a positive charged is moved towards a positive charge is it gaining or losing electrical potential energy?
6. A +5mC paint droplet is sprayed into an electric field between a car door charged at -200V and a plate 0.5 metres from the door charged at +200V.
(a) What is the Electric field strength in between the plate and the door?
(b) How much force will there be from this field on the droplet?
(c) How much electrical potential energy will the droplets lose as it travels from the middle of the field onto the door?

Part B: Magnetic:

1. Draw the magnetic field patterns due to electric currents in a straight wire, a flat circular coil and a solenoid.
2. Look at the diagram opposite
    a. Determine the direction of the force on the wire due to the interaction of its magnetic field and the magnets.
    b. If the field strength in between the magnets is 0.2T and approximately 0.1m of wire is affected by the field calculate the size of the force.