Edexcel GCSE Physics

Topic 11: Static electricity

Notes

(Content in bold is for Higher Tier only)

Static Electricity (Physics Only)

- A property of all matter
- Positive and negative charges exist
    - If a body has the same amount of positive and negative charge, they cancel out, forming a neutral body (i.e. protons and electrons in a neutral atom)
- Like Charges repel
- Opposite charges attract

Insulators do not conduct electricity

- Their electrons cannot flow throughout the material, they are fixed

Conductors can conduct electricity

- Their electrons can flow, and are not fixed (they are delocalised)

Static Electricity (Physics Only)

- When two insulators are rubbed together it can be charged by friction
    - Electrons are transferred from one object to the other
    - Forming a positive charge on one object and a negative charge on the other
- If conductors were rubbed, electrons will flow in/out of them cancelling out any effect, so they stay neutral
    - Insulators become charged because the electrons cannot flow
    - A positive static charge forms on object which loses electrons
    - A negative static charge forms on object which gains electrons
- Which object loses/gains electrons depends on the materials involved

Sparking occurs when enough charge builds up, and the objects are close but not touching

- The "spark" is when the charge jumps through the air from the highly negative object to the highly positive object, to balance out the charges
- Lightning occurs when the charge difference between clouds and the Earth becomes so great, and a massive spark (lightning) jumps across to balance the charge

Forces exerted (Physics only)

- The charged objects experience a force – electrostatic force (of attraction/repulsion)
- Greater charge = greater force (e.g. a more positive object, a more negative object)
- Closer together = greater force (force is proportional to the inverse square of the distance)
    - It is a noncontact force, as force can be felt even when the objects are not touching

Like charges repel, and unlike charges attract

- A positively charged balloon next to wall attracts electrons in the wall
    - This induction causes the balloon to stick to the wall
- Comb charged induces the opposite charge in small pieces of paper, so picks them up

Earthing (Physics only)

- This allows electrons to flow to the earth, removing excess charge
    - This allows materials to stay neutral

Applications (Physics only)

- Insecticide sprays are sprayed from aircraft, and given a charge
- This means the spray droplets repel each other
- So the droplets spread evenly, and are attracted to the earth
    - If not charged, there is a risk that some droplets will blow away, or the spray will fall unevenly

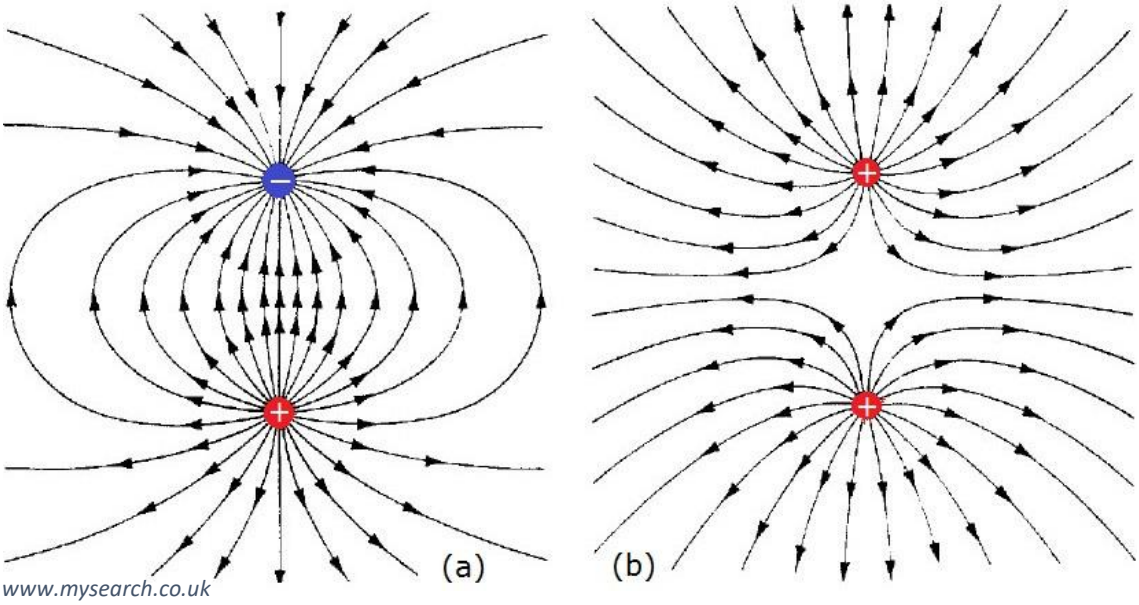
Dangers of Sparks (Physics only)

- if charge builds up and a spark forms when fuelling cars, it could ignite and cause a massive explosion
    - As fuel passes through a hose to the vehicle, a static charge can build up
    - When it is too large a spark might form
    - A resulting spark might ignite the fuel
    - The hoses are earthed to stop this occurring

Electric Fields (Physics only)

- Like magnetic fields for magnets, electric fields are for charges
    - An electric field is the region where an electric charge experiences a force
    - They point in the direction a positive charge would go
        - I.e. away from positive charges, and towards negative charges
    - They point to charges at right angles to the surface
- Stronger the charge, the more field lines present and the stronger the force felt
- Parallel plates have a uniform field

Diagrams



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