2.3 Electrostatics (P)

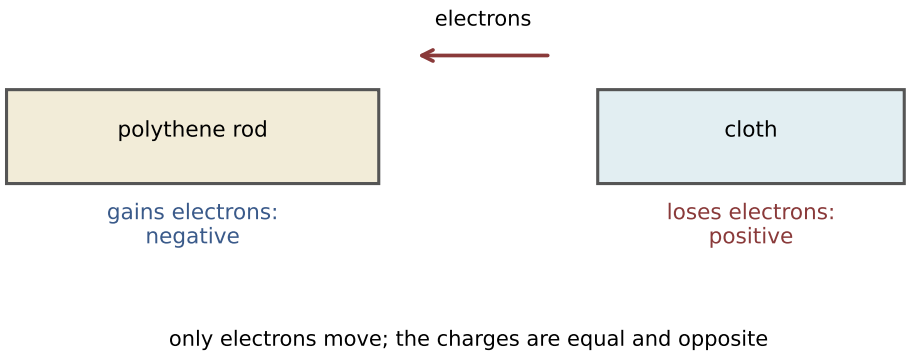
Name: _____ Class: _____ Date: _____ **Total: 17 marks**

Objective

Cover the electrostatics (P) extension (2.22P–2.28P): conductors and insulators, charging by friction, electron transfer, attraction and repulsion, dangers and uses. Original Physics-only practice.

1 Key knowledge and worked examples

■ Charge is electrons moving



Only **electrons** transfer. Rub a polythene rod with a dry cloth: electrons move cloth → rod, so the rod becomes **negative** and the cloth **positive** (equal amounts). Unlike charges attract; like charges repel.

■ Danger and use

Danger: fuelling aircraft and tankers – flowing fuel gathers charge, a spark can ignite vapour; earthed bonding cables keep everything at the same potential. **Uses**: photocopiers charge a drum so toner sticks where the image is; inkjet printers steer charged droplets.

2 Practice

2.1 (P) Name the particle transferred when insulators are charged by friction. [1]

2.2 (P) A balloon rubbed on hair sticks to a wall. Explain why. [3]

2.3 (P) State the force rule for like and unlike charges. [2]

2.4 (P) Give one danger of electrostatic charging during refuelling and the precaution used. [2]

3 Exam-style questions

3.1 (P) An acetate rod rubbed with a cloth becomes positive. Explain, in terms of particles, what happened to each object. [3]

3.2 (P) Describe how a photocopier uses electrostatic charge. [3]

3.3 (P) Explain why a charged plastic comb picks up small pieces of dry paper. [3]

Solutions

2.1 (P) Electrons.

2.2 (P) Rubbing transfers electrons to (or from) the balloon, charging it; the charged balloon induces an opposite charge on the wall's surface – charges in the wall's molecules shift; the unlike induced charge attracts, holding the balloon.

2.3 (P) Like charges repel; unlike charges attract.

2.4 (P) A spark from accumulated charge could ignite fuel vapour; the tanker/aircraft is connected to earth with a bonding conductor so charge drains away.

3.1 (P) Electrons are transferred from the rod to the cloth; the rod lost electrons so it has too few negatives – net positive; the cloth gained the same number, becoming equally negative.

3.2 (P) The drum is charged in the pattern of the image; oppositely charged toner powder sticks to the charged areas; toner transfers to paper and is fixed by heat.

3.3 (P) The comb's charge induces opposite charge on the near side of each paper piece, so the near side is attracted more strongly than the far side is repelled; the paper is light, so this net attraction lifts it.