



## Mark schemes

1

(a) **Level 2 (3–4 marks):**

A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points.

**Level 1 (1–2 marks):**

Simple statements are made, but not precisely. The logic is unclear.

**0 marks:**

No relevant content

**Indicative content**

- friction (between cloth and rod) causes
- electrons (to) move
- from the acetate rod **or** to the cloth
- (net) charge on cloth is now negative
- (net) charge on rod is now positive

4

(b) there is a force of attraction between the acetate rod and the cloth

(reason)

1

unlike charges attract

**or**

negative charges attract positive charges

1

(c) increase

1

(d)  $0.000025 \times 60\,000$

1

1.5 (J)

1

*accept 1.5 (J) with no working shown for 2 marks*

[9]

2

(a) negatively charged

1

electrons are transferred

1

from the (neutral) object

1

(b) minimum of four lines drawn perpendicular to surface of sphere

*judge by eye*

1

minimum of one arrow shown pointing away from sphere  
do **not** accept any arrow pointing inwards.

1

(c) Q

1

[6]

3

(a) 450

*allow 1 mark for correct substitution,  
ie  $18 \times 10 \times 2.5$  provided no subsequent step shown*

2

(b) (i) friction between child ('s clothing) and slide

*accept friction between two insulators*

*accept child rubs against the slide*

*accept when two insulators rub (together)*

1

causes electron / charge transfer (between child and slide)

*accept specific reference, eg electrons move onto / off the child / slide*

*reference to positive electrons / protons / positive charge / atoms transfer negates this mark*

*answers in terms of the slide being initially charged score zero*

1

(ii) all the charges (on the hair) are the same (polarity)

*accept (all) the charge/hair is negative / positive*

*accept it is positive/negative*

1

charges / hairs are repelling

*both parts should be marked together*

1

(iii) charge would pass through the metal (to earth)

*accept metal is a conductor*

*accept metal is not an insulator*

*accept there is no charge / electron transfer*

*accept the slide is earthed*

*accept metals contain free electrons*

1

[7]

4

(a) (i) electrons

1

a positive

1

(ii) (forces are) equal  
*accept (forces are)the same*  
*forces are balanced is insufficient*

1

(forces act in) opposite directions  
*accept (forces) repel*  
*both sides have the same charge is insufficient*

1

(b) aluminium

1

[5]

5

(a) 3<sup>rd</sup> box  
The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod.

1

(b) (i) friction between bottles and conveyor belt / (plastic) guides  
*accept bottles rub against conveyor belt / (plastic) guides*

1

charge transfers between bottles and conveyor belt / (plastic) guides  
*accept specific reference eg electrons move onto / off the bottles*  
*reference to positive electrons / protons negates this mark*

1

(ii) (the atom) loses or gains one (or more) electrons

1

(iii) charge will not (easily) flow off the conveyor belt / bottles  
*accept the conveyor belt / bottles is an insulator / not a conductor*  
*accept conveyor belt is rubber*

1

[5]

6

(a) (i) friction between the beads and pipe  
*accept beads rub against the pipe*

1

(cause) electrons to transfer  
*accept electrons are lost/gained*  
*do **not** accept negatively charged atoms for electrons*  
*3<sup>rd</sup> mark point only scores if 2nd mark scores*

1

from the pipe

do **not** accept from the (negatively) charged pipe

**or**

to the beads

do **not** accept to the (positively) charged beads

accept negative charge transfer to the beads for 1 mark provided

2<sup>nd</sup> or 3<sup>rd</sup> marking point not awarded

mention of positive charge transfer negates last 2 marking points

1

(ii) volume of beads

accept (75)cm<sup>3</sup>

**or**

length of pipe

accept use the same pipe

**or**

speed the beads are poured

poured the same way is insufficient

**or**

angle of pipe

1

(b) (i) the larger the beads the less charge

do **not** accept inversely proportional

negative correlation is insufficient

1

(ii) (total) charge decrease

results would be lower/smaller would be insufficient

1

beads in contact with pipe (walls) for less time

accept less contact (between beads and pipe)

accept beads in pipe for less time

**or**

smaller surface area (to rub against)

accept less pipe to rub against

less friction is insufficient

1

- (c) (i) (pumping very) fine powders  
*reason only scores if (very) fine powders given*
- greater charge (build up)  
*accept more static (electricity)*  
*accept an answer that correctly relates back to the experimental data*
- or**  
higher pd/voltage  
**or**  
greater energy  
*accept larger surface area to volume (ratio)*

1

- (ii) idea of earthing (the pipe)  
*accept use metal pipes*  
*do **not** accept use larger particles*

1

- (d) to compare (the relative risks)  
*fair test is insufficient*  
*you can only have one*  
*independent variable is insufficient*
- or**  
different conditions change the MIE value  
*accept different conditions change the results*  
*do **not** accept avoid bias*

1

[10]

7

- (a) electrons transfer / removed  
*do **not** accept negatively charged atoms for electrons*  
*this only scores if first mark given*

1

to the rod / from the cloth  
*this does not score if there is reference to any original charge on cloth or rod*  
*'it' refers to the rod*  
*accept negative charge transfer to rod / removed from cloth for 1 mark*  
*transfer of positive charge / positive electrons scores zero*

1

- (b) (i) rods / charges repel

1

creating downward / extra force (on the balance)  
*accept pushing (bottom) rod downwards*  
*do not accept increasing the weight / mass*  
*charges attracting scores zero*

1

- (ii) the (repulsion) force increases as the distance between the charges decreases

*accept there is a negative correlation between (repulsion) force and distance between charges*

**or**

*(repulsion) force and distance between charges are inversely proportional*

*for both marks*

*examples of 1 mark answers*

*force increases as distance decreases*

*force and distance are inversely proportional*

*negative correlation between force and distance*

*repels more as distance decreases*

*if given in terms of attracting or attraction force this mark does not score*

2

[6]

8

- (a) 3<sup>rd</sup> box

The negative charge in the water is repelled by the rod and the positive charge is attracted.

1

- (b) (i) friction between bottles and conveyor belt / (plastic) guides

*accept bottles rub against conveyor belt / (plastic) guides*

1

charge transfers between bottles and conveyor belt / (plastic) guides

*accept specific reference*

*eg electrons move onto / off the bottles*

*reference to positive electrons / protons negates this mark*

1

- (ii) an atom that has lost / gained electron(s)

*do **not** accept a charged particle*

1

- (iii) charge will not (easily) flow off the conveyor belt  
*accept the conveyor belt / bottle is an insulator / not a conductor*  
*accept conveyor belt is rubber*

1

[5]

9

- (a) fleece rubs against shirt  
*it refers to the fleece*

1

**or**  
friction (between fleece and shirt)

(causing) electrons to transfer from one to the other  
*accept a specific direction of transfer*  
*do **not** accept charge for electrons*  
*positive electrons negates this mark*  
*movement of protons negates this mark*

1

- (b) Electrical charges move easily through metals.

1

An electric current is a flow of electrical charge.

1

- (c) (i) copper  
*reason only scores if copper chosen*

1

(good electrical) conductor  
*accept it is a metal*  
*any mention of heat conduction negates this mark*

1

- (ii) lower than

1



(iii) accept any sensible suggestion, eg:

- too many variables (to control)
- lightning strikes / storms are random / unpredictable
- do not know which building will be struck
- do not know when a building will be struck
- do not know when lightning will happen
- (very) difficult to create same conditions in a laboratory
- lightning storms are not the same

*it is not safe is insufficient*

*do **not** accept lightning does not strike the same place twice*

1

[8]

10

(a) repel

1

opposite

1

attract

1

*correct order only*

(b) refuelling an aircraft

*reason cannot score if refuelling aircraft is not chosen*

1

a spark may cause an explosion / fire / ignite the fuel

*accept the static for a spark*

*accept named fuel*

*there must be a consequence of having a spark*

*do **not** accept answers in terms of people getting a shock or electrocuted*

1

[5]

11

- (a) each hair gains the same (type of) charge

**or**

(each) hair is negatively charged

*do **not** accept hair becomes positively charged*

**or**

(each) hair gains electrons

1

similar charges repel

*accept positive charges repel*

*providing first marking point is in terms of positive charge*

**or**

negative charges repel

**or**

electrons repel

1

- (b) 0.000002

*accept correct substitution and transformation for 1 mark*

**or**

$2 \times 10^{-6}$

*ie 30 / 15 or .03 / 15000 or 30 / 15000 or .03 / 15*

**or**

2  $\mu$  C

*answers 2 and 0.002 gain 1 mark*

2

- (c) current

*do **not** accept amp / amperes*

1

[5]

12

- (a) clothing and seat rub together

*accept friction between clothing and seat*

1

electrons transfer from seat to driver

**or**

electrons transfer from driver to seat

*accept electrons transfer on its own if first mark scores*

*an answer in terms of rubbing, between clothing and seat **and***

*charge transfer without mention of electrons gains 1 mark*

*an answer in terms of friction / rubbing **and** electron transfer without*

*mention of clothing and seat gains 1 mark*

1

(b) (i) how wet the air is affects charge (build up)

*accept humidity affects charge*

**or**

damp air is a better conductor

**or**

damp air has a lower resistance

*do **not** accept fair test or as a control unless explained*

1

(ii) No – it was only the lowest under these conditions

*accept answer in terms of changing the conditions may change the results*

**or**

No – there are lots of other materials that were not tested

**or**

Yes – the highest value for cotton is smaller than the lowest value for the other materials

*do **not** accept results show that it is always less / smallest*

1

[4]

13

(a) (i) electrons

1

jumper

1

(ii) positive

*accept protons*

*accept +*

1

(iii) positively charged

*accept any clear way of indicating the answer*

1

- (b) (i) copper 1
- it is an (electrical) conductor
- only accept if copper is identified*
- do **not** accept it conducts heat*
- accept it conducts heat and electricity*
- accept copper is the best conductor*
- accept correct description of conduction* 1
- (ii) current 1

[7]

14

- (a) becomes (electrically) charged or description of electron movement  
*for 1 mark* 1
- (b) comb attracts paper  
*for 1 mark* 1
- (c) charge/electricity gone to Earth/body  
*for 1 mark each* 2

[4]

15

- (a) (i) Ends have charge  
Which is opposite on each rod 2
- (ii) Attracts 1
- (b) (i) Repulsion 1
- (ii) Ends have same charge 1

- (c) Electrons move between cloth and rod  
 Where gather is negative  
 Where move from is positive

3

[8]

16

- (a) (i) (bottom **or** other ends) move apart or  
 repel

*accept they move apart*

1

- (ii) have same charge

*accept both have negative charge*

*(from part (b) do not credit both have positive charge*

same **or** like charges repel

*not just opposite charges attract*

2

- (b) positive

1

electrons

1

cloth

1

polythene

*accept strips*

1

- (c) (i) conductors

*accept metals*

1

- (ii) insulators

*accept non-conductors/poor conductors do not credit  
 non-metals*

1

[9]