

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) 3rd 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*
3rd 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*

2nd or 3rd marking point not awarded

mention of positive charge transfer negates last 2 marking points

1

(ii) volume of beads

accept (75)cm³

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) 3rd 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
 2×10^{-6}
ie 30 / 15 or .03 / 15000 or 30 / 15000 or .03 / 15
or
 $2 \mu\text{C}$
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]