M1. (a) 450

*allow **1** mark for correct substitution,*
ie 18 × 10 × 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]

M2. (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]

M3. (a) clothing and seat rub together

accept friction between clothing and seat

1

<u>electrons</u> transfer from seat to driver

or

<u>electrons</u> 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 <u>always</u> less / smallest*

1

[4]

M4. (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 <u>atom</u> that has lost / gained <u>electron</u>(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]

M5. (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 <u>charges</u>decreases

*accept there is a negative correlation between (repulsion) force and distance between <u>charges</u>**or**(repulsion) force and distance between <u>charges</u> 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]

M6. (a) (i) friction between the beads and pipe

accept beads rub against the pipe

1

(cause) <u>electrons</u> 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) <u>volume</u> of beads

accept (75)cm³

or

<u>length</u> 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

orhigher 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

ordifferent conditions change the MIE value

accept different conditions change the results

*do **not** accept avoid bias*

1

[10]

M7. (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]