Static Electricity

These practice questions can be used by students and teachers and is

Suitable for GCSE AQA Physics Topic Question 8463

Level: GSCE AQA 8463

Subject: Physics

Exam Board: GCSE AQA

Topic: Static Electricity

Q1.

Figure 1 shows a student walking on a carpet.

Figure 1

(a) The student becomes negatively charged because of the friction between her socks and the carpet.

Explain why the friction causes the student to become charged.

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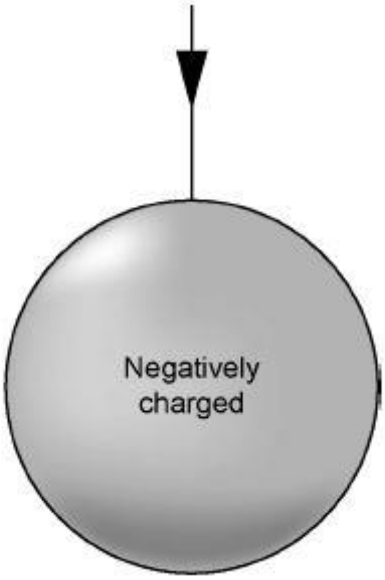
(2)

(b) The student's head is represented by the sphere in **Figure 2**.

The student is negatively charged. The arrow shows part of the electric field around the student's head.

Draw **three** more arrows on **Figure 2** to complete the electric field pattern.

Figure 2



(1)

(c) The negatively charged student touches a metal tap and receives an electric shock.

Explain why.

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(3)

(d) Some carpets have thin copper wires running through them. The student is less likely to receive an electric shock after walking on this type of carpet.

Suggest why.

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(2)

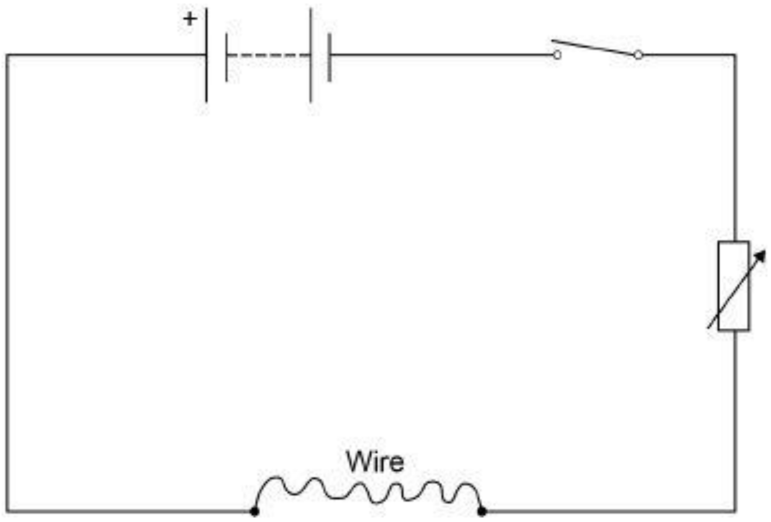
(Total 8 marks)

Q2.

A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 1 shows part of the circuit the student used.

Figure 1



(a) Complete **Figure 1** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

(3)

(b) Describe how the student would obtain the data needed for the investigation.

Your answer should include a risk assessment for **one** hazard in the investigation.

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(6)

(c) Why would switching off the circuit between readings have improved the accuracy of the student's investigation?

Tick **one** box.

The charge flow through the wire would not change.	☐
The potential difference of the battery would not increase.	☐
The power output of the battery would not increase.	☐
The temperature of the wire would not change.	☐

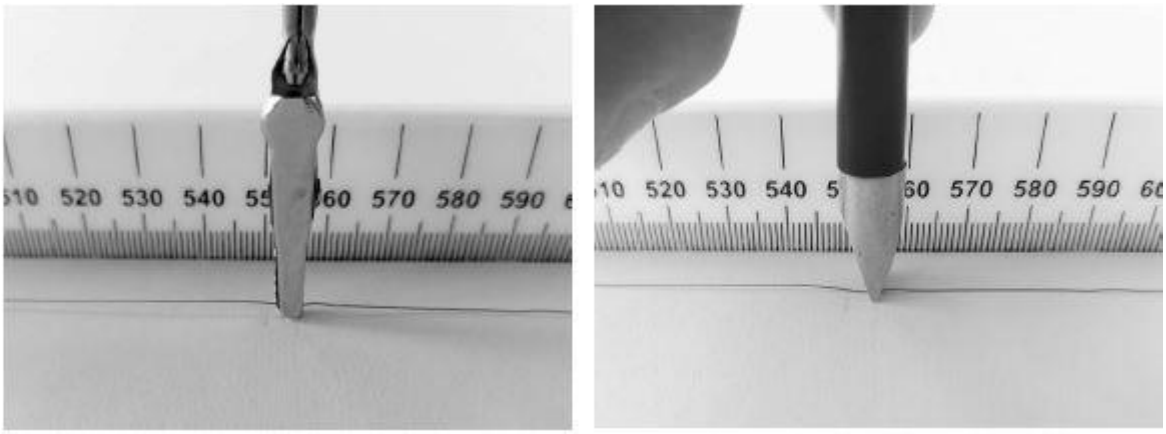
(1)

(d) The student used crocodile clips to make connections to the wire.

They could have used a piece of equipment called a 'jockey'.

Figure 2 shows a crocodile clip and a jockey in contact with a wire.

Figure 2



Crocodile clip   Jockey

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

The accuracy of the student's results would be higher.	☐

The accuracy of the student's results would be lower.	☐
The accuracy of the student's results would be the same.	☐
The resolution of the length measurement would be higher.	☐
The resolution of the length measurement would be lower.	☐
The resolution of the length measurement would be the same.	☐

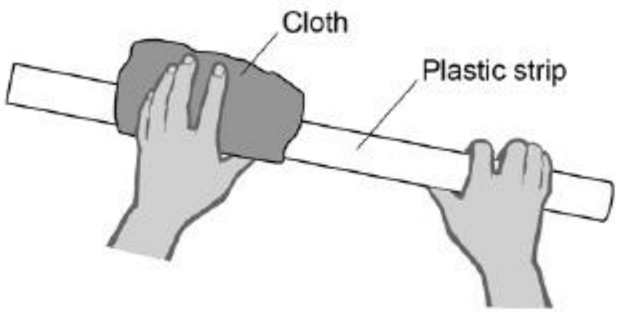
(2)
(Total 12 marks)

Q3.

A student used some everyday items to investigate static electricity.

Figure 1 shows a flexible plastic strip being rubbed with a cloth.

Figure 1



(a) Complete the sentence.

Choose the answer from the box.

electrons	**neutrons**	**protons**

Rubbing the plastic strip with the cloth causes the strip to become negatively charged because ____________________ move from the cloth onto the plastic strip.

(1)

(b) Complete the sentence.

Choose the answer from the box.

a negative	**a positive**	**zero**

The cloth is left with ____________________ charge.

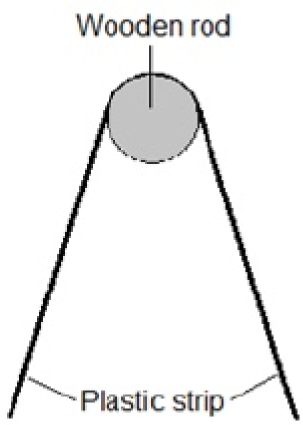
(1)

(c) The student hung the plastic strip over a wooden rod.

The ends of the strip moved away from each other.

Figure 2 shows the position of the plastic strip on the wooden rod.

Figure 2



What **two** conclusions should the student make about the forces acting on the two halves of the plastic strip?

1. ____

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2. ____

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(2)

(d) Another student repeated the experiment using the same method and found the plastic strip moved in the same way.

Complete the sentence.

Choose the answer from the box.

an anomaly	**repeatable**	**reproducible**

The investigation was ______________________ .

(1)

(Total 5 marks)

Q4.

Sources of background radiation are either natural or man-made.

(a) Which **two** of the sources listed in the table are natural sources of background radiation?

Tick **two** boxes.

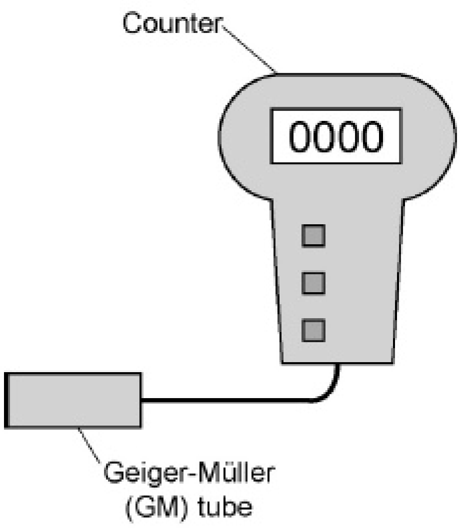
Cosmic rays	☐
Medical X-rays	☐
Nuclear power stations	☐
Nuclear weapons testing	☐
Radon gas	☐

(2)

A teacher used a Geiger-Müller (GM) tube and counter to measure the background radiation in his laboratory.

Figure 1 shows the GM tube and counter.

Figure 1



(b) The table gives three readings taken by the teacher at three different times on the same day.

Counts in 1 minute

16
21
18

What is the most likely reason for the readings being different?

Tick **one** box.

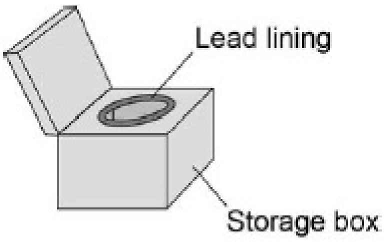
Radioactive decay is a random process.	☐
The air pressure in the laboratory increased.	☐
The background radiation increased during the day.	☐
The temperature in the laboratory decreased.	☐

(1)

(c) The teacher takes a radioactive source from a storage box.

Figure 2 shows the box.

Figure 2



Why does storing the radioactive source in the box reduce the risk of radiation exposure to the teacher?

Tick **one** box.

The lead lining absorbs the emitted radiation.	☐
The lead lining reflects the emitted radiation.	☐
The lead lining transmits the emitted radiation.	☐

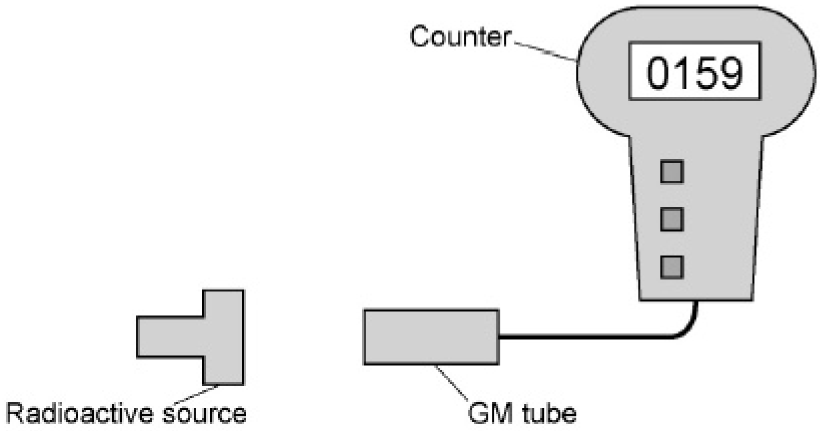
(1)

(d) **Figure 3** shows how the teacher used the GM tube and counter to measure the radiation emitted from the radioactive source.

The counter was reset to zero.

The count after one minute was 159.

Figure 3



How should the teacher calculate the counts from the radioactive source?

Tick **one** box.

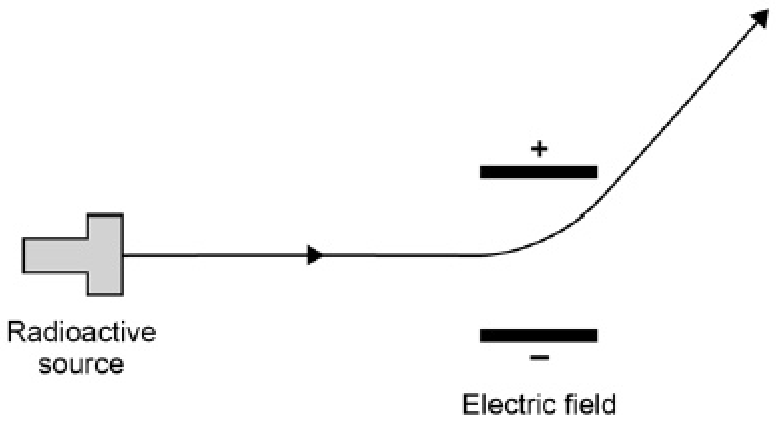
Add the background count to 159	☐
Divide the background count by 159	☐
Multiply the background count by 159	☐
Subtract the background count from 159	☐

(1)

(e) The teacher passed the radiation through an electric field.

Figure 4 shows the path that the radiation took through the electric field.

Figure 4



What type of radiation was being emitted by the radioactive source?

Tick **one** box.

Alpha ☐ Beta ☐ Gamma ☐ Neutron ☐

Explain the reason for your answer.

____

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____

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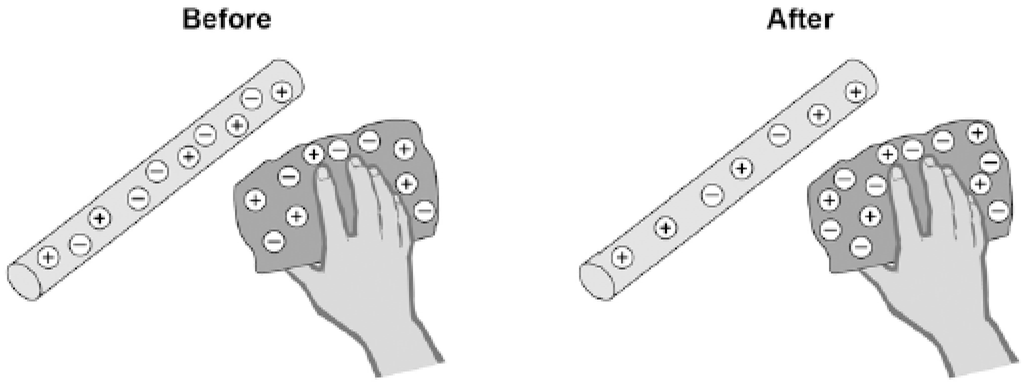
(3)
(Total 8 marks)

Q5.

A student rubs an acetate rod with a cloth.

Figure 1 shows the charges on the acetate rod and cloth before and after rubbing.

Figure 1



(a) Explain how rubbing an acetate rod with a cloth causes the rod and cloth to become charged.

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(4)

(b) After charging them, the student moves the acetate rod and the cloth closer together.

Which statement is correct?

Tick **one** box.

There is no force between the acetate rod and the cloth.	☐
There is a force of attraction between the acetate rod and the cloth.	☐
There is a force of repulsion between the acetate rod and the cloth.	☐

Give a reason for your answer.

____

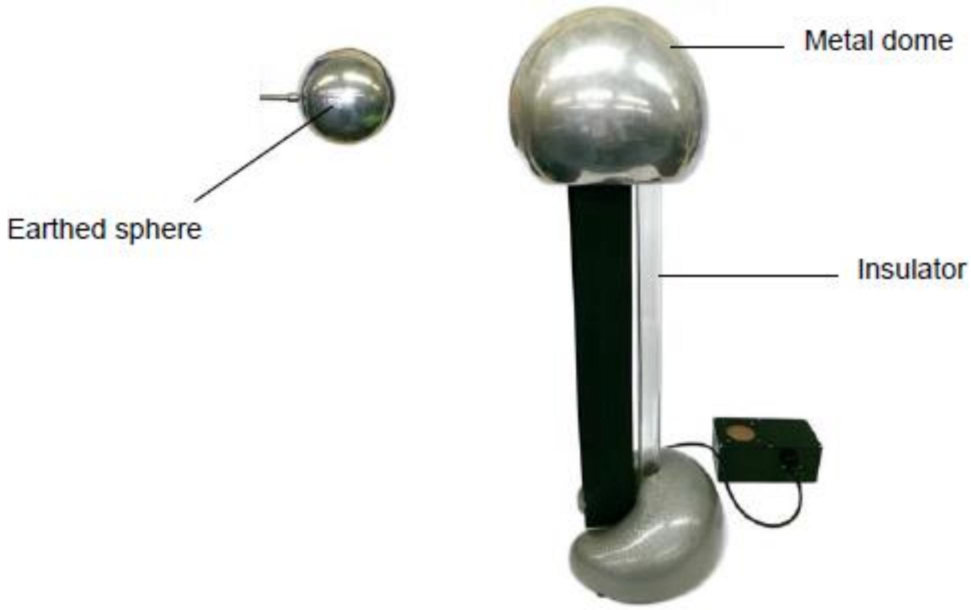
____

____

(2)

(c) **Figure 2** shows a Van de Graaff generator, which is used to generate static electricity.

Figure 2



© Michael Priest

The longer the Van de Graaff generator is switched on, the more charge is stored on the metal dome.

Use an answer from the box to complete the sentence.

decrease	**increase**	**stay the same**

The amount of charge on the metal dome is increased, which causes the potential difference between the metal dome and the earthed sphere to ________________ .

(1)

(d) When the potential difference between the Van de Graaff generator and the earthed sphere is 60 kV, a spark jumps between the metal dome and the earthed sphere.

The spark transfers 0.000025 coulombs of charge to the earthed sphere.

The equation which links charge, energy and potential difference is:

energy transferred = charge × potential difference

Calculate the energy transferred by the spark.

____

____

Energy transferred = ______________________ J

(2)

(Total 9 marks)

Q6.

Figure 1 shows a Van de Graaff generator that is used to investigate static electricity.

Before it is switched on, the metal dome has no net charge.

After it is switched on, the metal dome becomes positively charged.

Figure 1

© Michael Priest

(a) Explain how an uncharged object may become positively charged.

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____

____

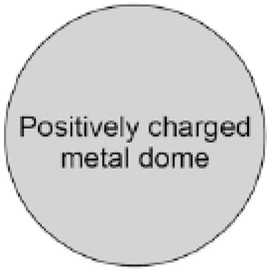
(3)

(b) **Figure 2** shows a plan view of the positively charged metal dome of a Van de Graaff generator.

Draw the electric field pattern around the metal dome when it is isolated from its surroundings.

Use arrows to show the direction of the electric field.

Figure 2

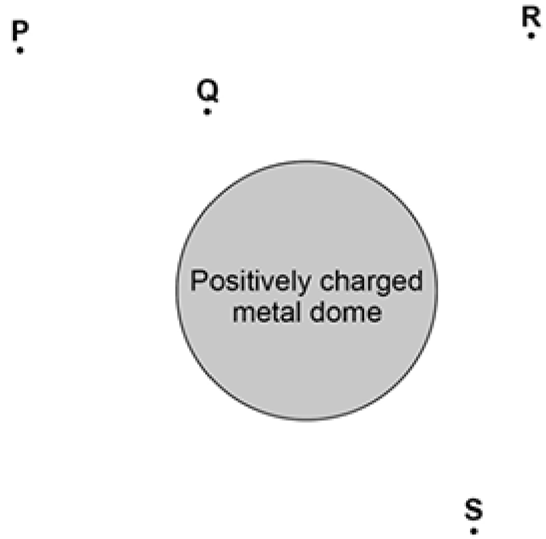


(2)

(c) Another positively charged object is placed in the electric field.

Look at **Figure 3**.

Figure 3



In which position would the object experience the greatest force?

Tick **one** box.

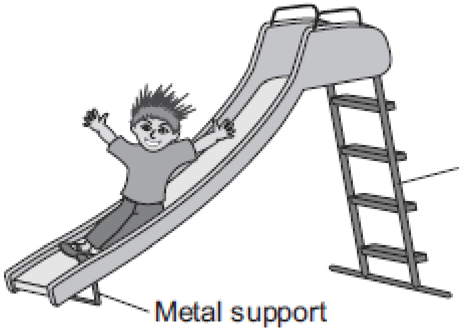
P	☐
Q	☐
R	☐
S	☐

(1)

(Total 6 marks)

Q7.

The figure below shows a slide in a children's playground.



(a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N / kg

____

____

____

Decrease in gravitational potential energy = _______________ J

(2)

(b) The slide is made of plastic.

(i) The child becomes electrically charged when he goes down the slide.

Explain why.

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____

____

____

(2)

(ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made from this observation?

Give a reason for your answer.

(2)

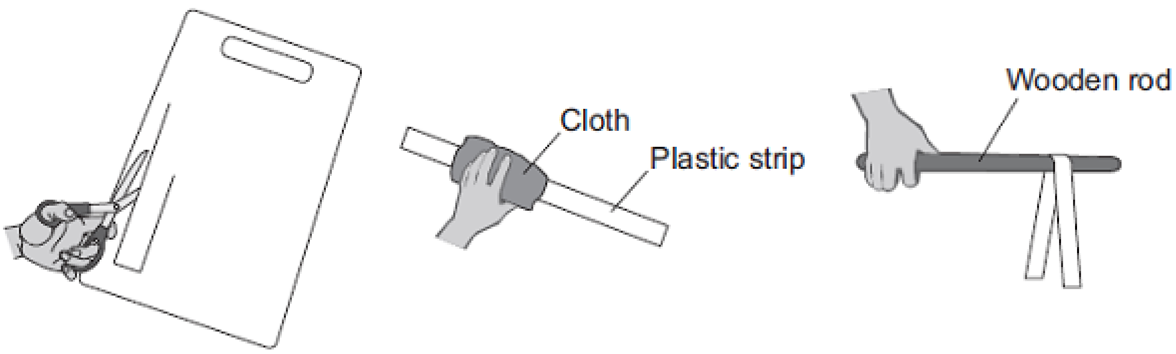
(iii) Why would the child **not** become electrically charged if the slide was made from metal?

(1)

(Total 7 marks)

Q8.

(a) A student uses some everyday items to investigate static electricity.



1 A strip of plastic is cut from a plastic carrier bag

2 The plastic strip is rubbed with a cloth

3 The plastic strip is hung over a wooden rod

(i) Draw a ring around the correct answer in the box to complete each sentence.

Rubbing the plastic strip with a cloth causes the strip to become negatively charged.

This happens because [electrons / neutrons / protons] move from the cloth onto the plastic strip.

[a negative

The cloth is left with | a positive / zero | charge.

(2)

(ii) When the plastic strip is hung over the wooden rod, the two halves of the strip move equally away from each other.

What **two** conclusions should the student make about the forces acting on the two halves of the plastic strip?

1. ____

____

2. ____

____

(2)

(b) Electrical charges move more easily through some materials than through other materials.

Through which **one** of the following materials would an electrical charge move most easily?

Draw a ring around your answer.

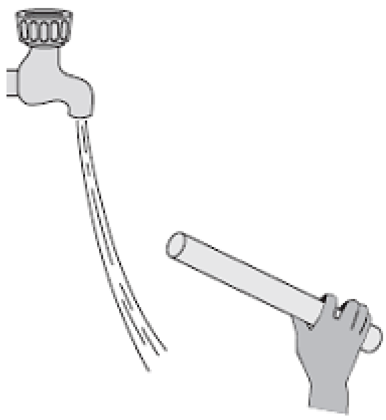
aluminium **glass** **rubber**

(1)

(Total 5 marks)

Q9.

(a) The diagram shows a negatively charged plastic rod held near to a thin stream of water. The water is attracted towards the rod.



Which **one** of the following statements explains what is happening to the charge in the water?

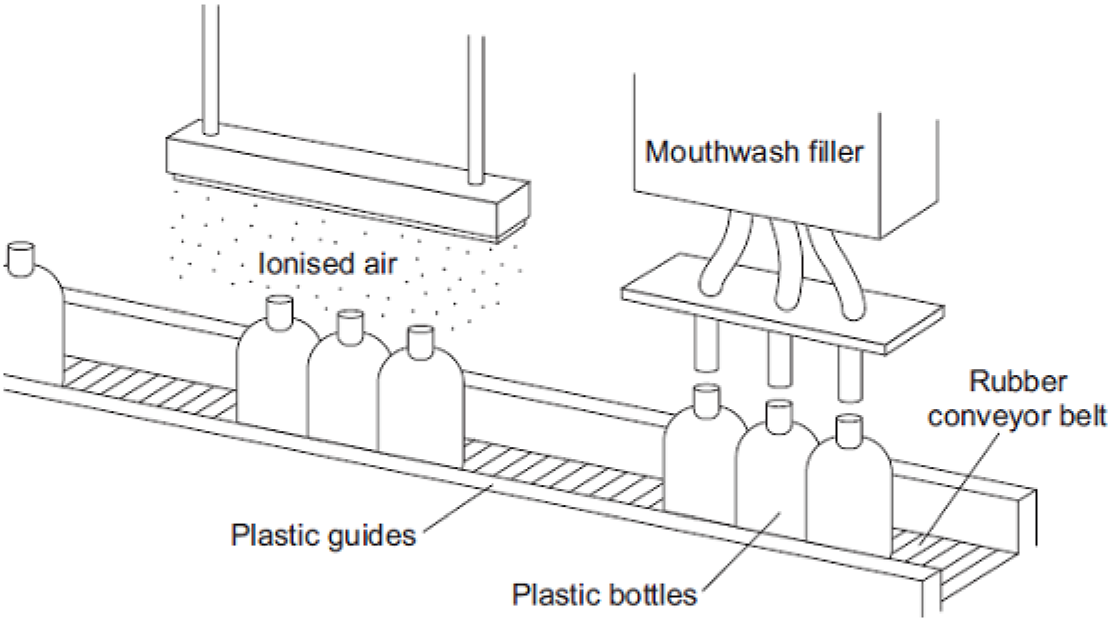
Tick (✓) **one** box.

The positive and the negative charges in the water are attracted to the rod.	☐
The positive and the negative charges in the water are repelled by the rod.	☐
The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod.	☐
The negative charge in the water is attracted to the rod and the positive charge is repelled by the rod.	☐

(1)

(b) A company that produces bottles of mouthwash found a problem with the automatic filling system.

As the bottles go towards the filler, the bottles move around on the conveyor belt and become electrostatically charged. This causes the stream of mouthwash to move sideways, missing the open top of the bottle.



The company came up with an answer to the problem. Before the bottles reach the dfiller, the bottles pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

(i) Explain why the plastic bottles became charged.

___

___

(2)

(ii) What happens to the structure of an atom to change the atom into an ion?

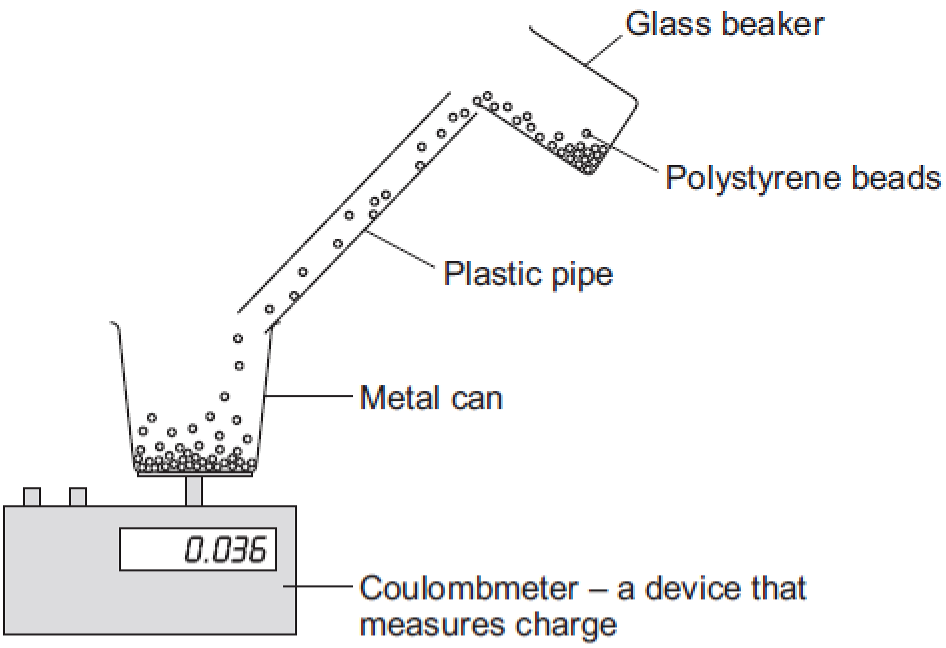
(1)

(iii) Earthing the conveyor belt with a conducting wire would not have solved this problem.
Give a reason why.

(1)
(Total 5 marks)

Q10.

(a) Fine powders poured through a pipe can become charged. The diagram shows the apparatus used by a student to investigate this effect.



The student poured 75 cm^3 of polystyrene beads down the pipe. The beads fell into a metal can and the charge on them was measured directly using a coulombmeter.

The student repeated this twice more, but each time used 75 cm^3 of beads of a different size.

(i) When they fell through the pipe, the polystyrene beads became negatively charged.

Explain how this happened.

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___

(3)

(ii) Give **one** control variable in the student's investigation.

___

___

(1)

(b) The results obtained by the student are shown in the table.

Diameter of polystyrene beads in mm	Charge in microcoulombs
1.0	0.080
2.0	0.044
3.0	0.012

(1 000 000 microcoulombs = 1 coulomb)

(i) Describe the connection between the size of the polystyrene beads and the total charge on the beads.

___

___

(1)

(ii) Explain how these results might be different if the student had used a shorter pipe.

___

___

___

___

(2)

(c) In industry, powders are often pumped through pipes. If the static charge caused a spark, the powder could ignite and cause an explosion.

(i) Is an explosion more likely to happen when pumping very fine powders or when pumping powders that consist of much larger particles?

____

Give a reason for your answer.

____

____

(1)

(ii) Suggest **one** way that the risk of an explosion could be reduced.

____

____

(1)

(d) The table gives the minimum ignition energy (MIE) value for a number of fine powders.
The MIE is the minimum amount of energy required to cause a fine powder to ignite.

Type of powder	**MIE in millijoules**
Coal dust	60.00
Aluminium powder	10.00
Cornstarch dust	0.30
Iron powder	0.12

The MIE values for different substances are all measured in the same way and under the same conditions of pressure and temperature.

Why is this important?

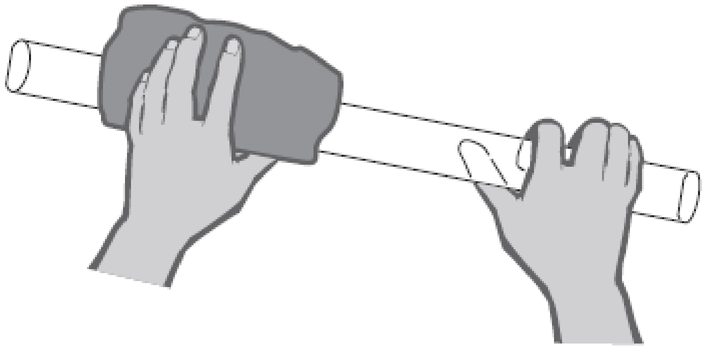
____

____

(1)
(Total 10 marks)

Q11.

(a) The diagram shows a polythene rod being rubbed with a woollen cloth.



The polythene rod becomes negatively charged.

Explain how this happens.

____

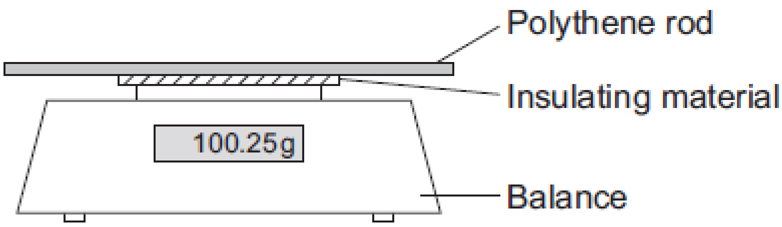
____

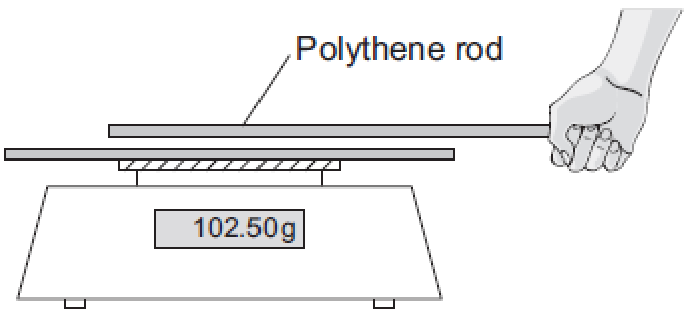
____

____

(2)

(b) A student put the charged polythene rod on to a balance. The rod was separated from the metal pan of the balance by a thin block of insulating material.
The student then held a second charged polythene rod above, but **not** touching, the first rod. The reading on the balance increased.





(i) Explain why the reading on the balance increases.

____

____

____

____

(2)

(ii) The student observed that the nearer the two rods are to each other, the bigger the increase in the balance reading.

What should the student conclude from this observation?

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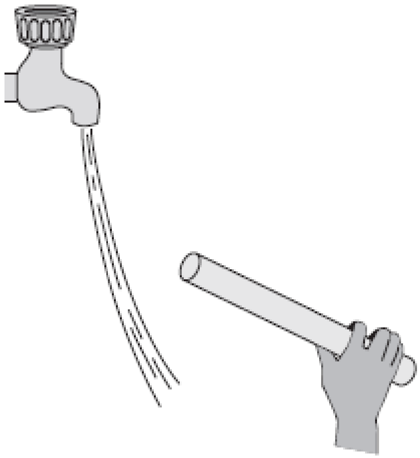
(2)
(Total 6 marks)

Q12.

(a) The diagram shows a negatively charged plastic rod held close to a thin stream of water. The water is attracted towards the rod.



Which **one** of the following statements explains what is happening to the charge in the water?

Tick (✓) **one** box.

The positive and the negative charges in the water are attracted to the rod. ☐

The positive and the negative charges in the water are repelled by the rod. ☐

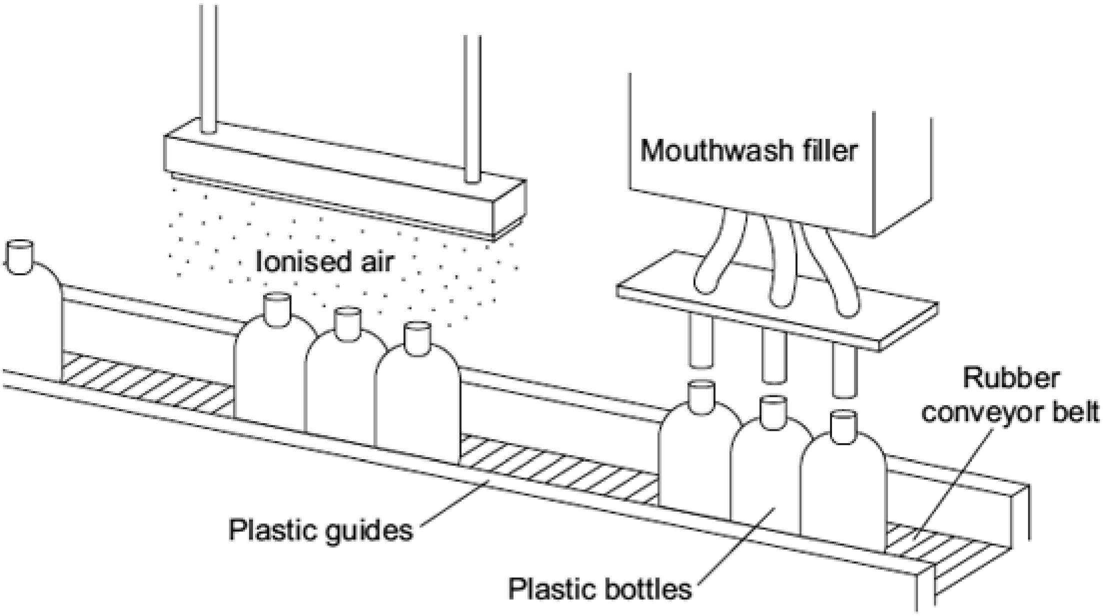
The negative charge in the water is repelled by the rod and the positive charge is attracted. ☐

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

(1)

(b) A company that produces bottles of mouthwash found a problem with the automatic filling system.

As the bottles go towards the filler, they move around on the conveyer belt and become electrostatically charged. This causes the stream of mouthwash to move sideways, missing the open top of the bottle.



The company came up with a solution to the problem. Before the bottles reach the filler, they pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

(i) Explain why the plastic bottles become charged.

___

___

___

___

(2)

(ii) What is an ion?

___

____ **(1)**

(iii) Earthing the conveyor belt with a conducting wire would not have solved this problem.

Give a reason why.

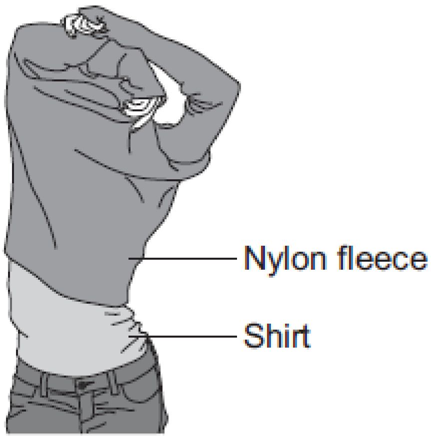
____

____ **(1)**

(Total 5 marks)

Q13.

(a) A student takes off his nylon fleece and feels a small electric shock.
He realises that this happens because his fleece becomes charged.



Explain why the fleece becomes charged.

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____ **(2)**

(b) Only **two** of the following statements are correct.

Put a tick (✓) in the boxes next to the **two** correct statements.

Positively charged objects repel negatively charged objects. ☐

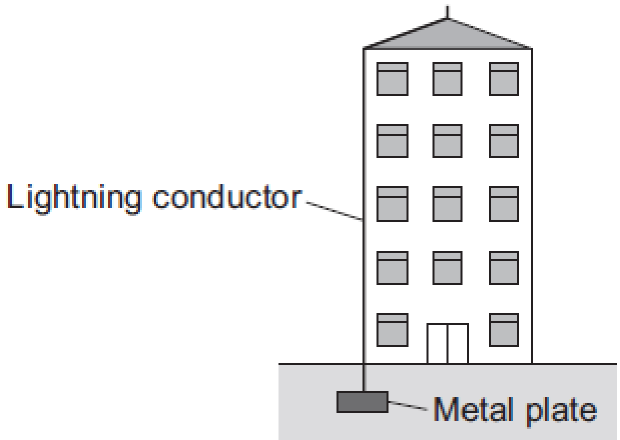
Electrical charges move easily through metals. ☐

Static electricity is safe; it never causes any danger. ☐

An electric current is a flow of electrical charge. ☐

(2)

(c) The diagram shows a lightning conductor attached to the side of a tall building.



If the building is struck by lightning, charge flows to earth through the lightning conductor.

(i) Which of the materials in the list is used to make the lightning conductor?

Draw a ring around your answer.

copper **glass** **plastic**

Give a reason for your answer.

____

____

____

(2)

(ii) Complete the sentence by drawing a ring around the correct line in the box.

The resistance of the lightning conductor is

higher than the same as lower than	the resistance of the building.

(1)

(iii) It is almost impossible to test different designs of lightning conductor in controlled experiments during a lightning storm.

Suggest a reason why.

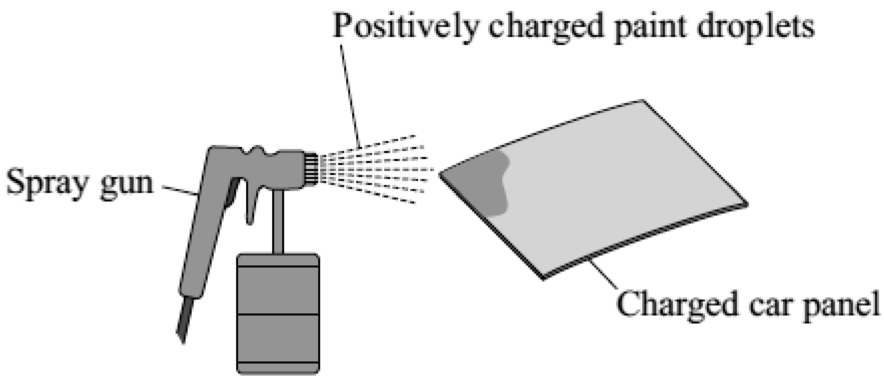
____

____

(1)
(Total 8 marks)

Q14.

(a) The diagram shows how static electricity is used to paint a metal car panel.



Use words from the box to complete the following sentences.

attract	**opposite**	**repel**	**same**

All the paint droplets have the same type of charge. This makes the paint droplets

____________________________ each other and spread out.

The car panel and the paint droplets have the ___________________________ type of

charge. This causes the car panel to ________________________ the paint droplets.

The car panel is covered by an even layer of paint.

(3)

(b) In which **one** of the following situations is static electricity dangerous and not useful?

Put a tick (✓) in the box next to your answer.

using a photocopier ☐

refuelling an aircraft ☐

a smoke precipitator ☐

Give a reason for your answer.

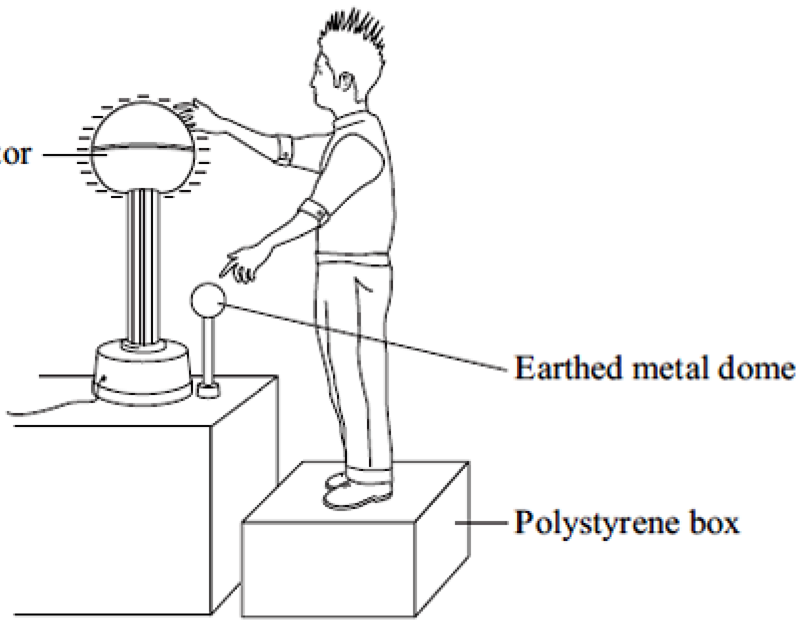
____

____

(2)
(Total 5 marks)

Q15.

(a) The diagram shows a student touching the metal dome of a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain why the student's hair stands on end when the generator is switched on.

____

____

____

(2)

(b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Calculate the charge carried by the spark.

___

___

Charge transferred =___ coulombs

(2)

(c) What name is given to the rate of flow of charge?

___

(1)

(Total 5 marks)

Q16.

During car journeys, the driver will often become electrostatically charged.

This is more noticeable on dry days than on damp, humid days.

(a) Explain what happens to cause the driver to become charged.

___

___

___

___

(2)

(b) Scientists were asked to find out whether the build-up of charge on the driver depends on the type of material used to make the driver's clothes. The results of the investigation are given in the table.

Material	Humidity	Temperature in °C	Charge on the driver in millicoulombs
Nylon	48%	18	3.0 to 3.2
Wool	48%	18	2.4 to 2.5
Cotton	48%	18	1.4 to 1.7

Humidity is a measure of how much water vapour the air can hold.

(i) Why was it important that the scientists controlled the humidity?

___

____

(1)

(ii) Does the data in the table show that the charge on the driver would always be less if they were to wear cotton clothing?

Give a reason for your answer.

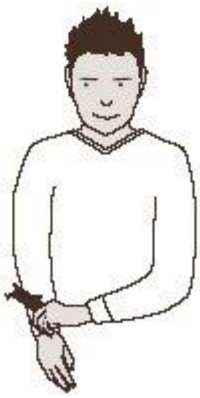
____

____

(1)
(Total 4 marks)

Q17.

(a) A student rubs a nylon comb on the sleeve of his jumper.



(i) Use words from the box to complete the following sentence.

electrons	**hand**	**jumper**	**protons**

The comb becomes negatively charged because ____________________ move

from the student's ________________________ to the comb.

(2)

(ii) What type of charge is left on the jumper?

____

(1)

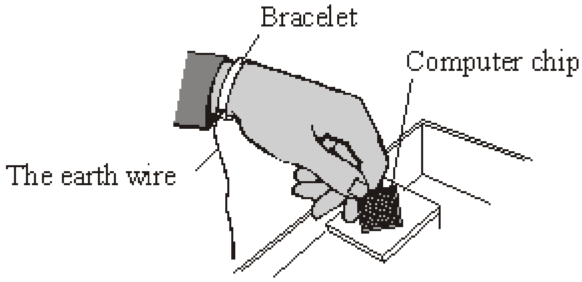
(iii) The negatively charged comb is placed close to a charged plastic ruler. The comb and the ruler attract each other.

Complete the following sentence by drawing a ring around the correct line in the box.

The ruler is	negatively charged positively charged uncharged

(1)

(b) Electrostatic charge can damage computer chips. People working with computer chips may wear a special bracelet, with a wire joining the bracelet to earth (the earth wire). Any negative charge on the person will flow through the wire to earth.



(i) Which **one** of the following materials should the bracelet be made from?

Draw a ring around your answer.

copper **plastic** **rubber**

Give a reason for your answer.

____

____

(2)

(ii) Which **one** of the following words is used to describe the rate of flow of charge through a wire?

Draw a ring around your answer.

current **resistance** **voltage**

(1)

(Total 7 marks)

Q18.

You wash and dry your hair, then comb it with a plastic comb. As you move the comb away from your head some hairs are attracted to the comb.

(a) What has happened to the comb to make it attract the hairs?

____

(1)

(b) If the comb is now held above some small pieces of dry tissue paper what is likely to happen?

(1)

(c) If you rub your hands all over the comb it will no longer attract your hair. Explain why.

(2)

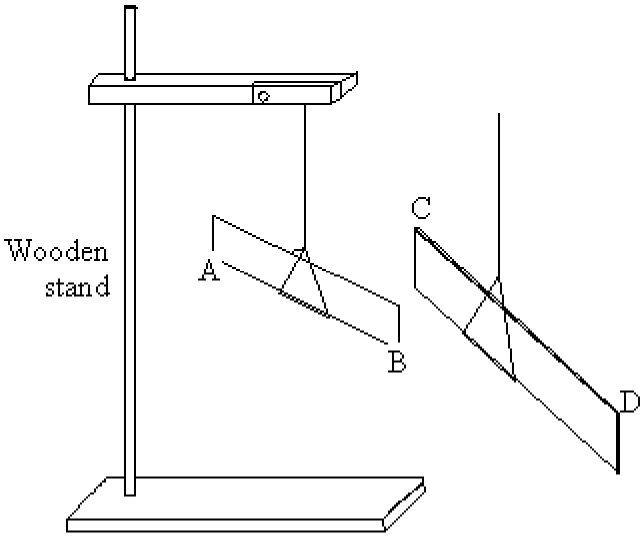
(Total 4 marks)

Q19.

A pupil did an experiment following the instructions below.

1. Take a polythene rod (AB), hold it at its centre and rub both ends with a cloth.
2. Suspend the rod, without touching the ends, from a stand using a stirrup and nylon thread.
3. Take a perspex rod (CD) and rub it with another cloth.
4. Without touching the ends of the perspex rod bring each end of the perspex rod up to, but without touching, each end of the polythene rod.
5. Make notes on what is observed.

The diagram below shows how the apparatus is to be set up.



(a) When end C was brought near to end B they attracted each other.

(i) Explain why they attracted each other.

____

____

(ii) What would happen if end C were brought near end A?

____

(3)

(b) The experiment was repeated with two polythene rods.

(i) Describe what you would expect the pupil to observe as the end of one rod was brought near to the end of the other.

____

____

(ii) Explain your answer.

____

____

(2)

(c) Explain, in terms of electron movement, what happened as the rods were rubbed with the cloths.

____

____

____

____

____

(3)
(Total 8 marks)

Q20.

A student did an experiment with two strips of polythene. She held the strips together at one end. She rubbed down one strip with a dry cloth. Then she rubbed down the other strip with the dry cloth. Still holding the top ends together, she held up the strips.

(a) (i) What movement would you expect to see?

____

____

(1)

(ii) Why do the strips move in this way?

____

(2)

(b) Complete the **four** spaces in the passage.

Each strip has a negative charge. The cloth is left with a______________________

charge. This is because particles called _________________ have been transferred

from the __________________ to the ____________________ .

(4)

(c) The student tried the experiment using two strips of aluminium. The strips did not move.

Complete **each** of the sentences.

(i) Materials, such as aluminium, which electricity will pass through easily, are

called ____________________ .

(1)

(ii) Materials, such as polythene which electricity will **not** pass through easily, are

called _____________________ .

(1)

(Total 9 marks)

Mark schemes

Q1.

(a) transfer of electrons

mention of positive charge moving negates both marks

1

from the carpet to the student

1

(b) three arrows perpendicular to sphere's surface with all arrows directed inwards and distributed evenly around sphere

1

(c) there is a potential difference between the student and the tap

*do **not** accept the tap / sink is charged*

1

which causes electrons / charges to transfer from the student
or
which causes electrons / charges to transfer to the tap

1

which earths the charge

allow the tap is earthed

1

(d) carpet / copper has a low resistance

allow carpet is a conductor
or
copper is a conductor

1

lower / no build-up of charge (on the student)
or
(so there is a) smaller / no potential difference between student and tap / earth

1

[8]

Q2.

(a) ammeter and voltmeter symbols correct

1

voltmeter in parallel with wire

1

ammeter in series with wire

1

(b) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- length measured
- length varied
- current measured
- potential difference measured
- repeat readings
- calculate resistance for each length
- $\text{resistance} = \dfrac{\text{potential difference}}{\text{current}}$
- plot a graph of resistance against length

- hazard: high current
- may cause wire to melt / overheat
- may cause burns (to skin)
- use low currents

(c) the temperature of the wire would not change

1

(d) the accuracy of the student's results would be higher

1

the resolution of the length measurement would be higher

1

[12]

Q3.

(a) electrons

1

(b) a positive

1

(c) the forces are repulsive

allow the forces act in opposite directions

1

the forces are equal in size

allow the forces are the same (size)

1

(d) reproducible

1

[5]

Q4.

(a) cosmic rays

1

radon gas

1

(b) radioactive decay is a random process

1

(c) the lead lining absorbs the emitted radiation

1

(d) subtract the background count from 159

1

(e) beta

1

beta is negatively charged

1

(so is) attracted to positive plate
or
(so is) repelled by negative plate

1

[8]

Q5.

(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 × 60 000 1

1.5 (J) 1

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

[9]

Q6.

(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]

Q7.

(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]

Q8.

(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]

Q9.

(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]

Q10.

(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)cm^3

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]

Q11.

(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]

Q12.

(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]

Q13.

(a) fleece rubs against shirt

it refers to the fleece

1

or

friction (between fleece and shirt)

(causing) <u>electrons</u> 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]

Q14.

(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]

Q15.

(a) each hair gains the <u>same</u> (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 μ C

*answers 2 and 0.002 gain **1** mark*

2

(c) current

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

1

[5]

Q16.

(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 always less / smallest*

1

[4]

Q17.

(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]

Q18.

(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]

Q19.

(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]

Q20.

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

accept they move apart

1

(ii) have <u>same</u> 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]