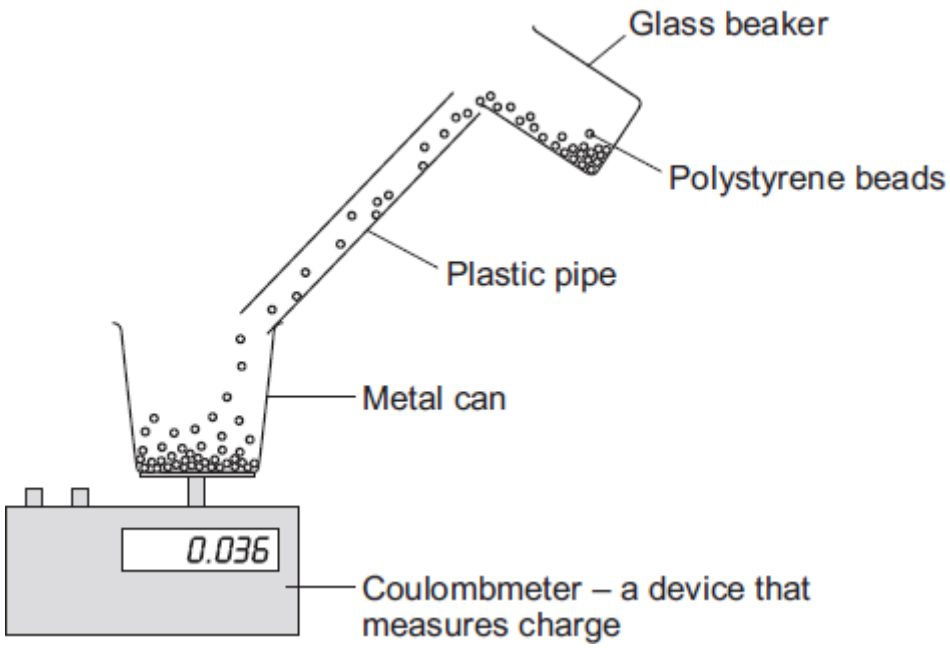
**Name of the Student**:_____

**Max. Marks : 22 Marks** **Time : 22 Minutes**

## Q1.

(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.

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**(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.

_____

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**(1)**

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

_____

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**(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)**

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(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?

_____

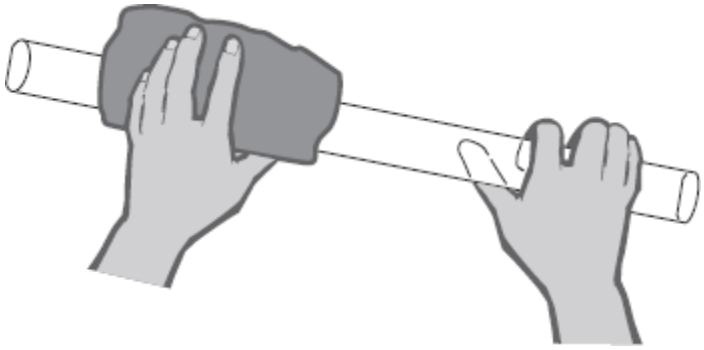
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**(1)**

**(Total 10 marks)**

## Q2.

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



The polythene rod becomes negatively charged.

Explain how this happens.

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_____

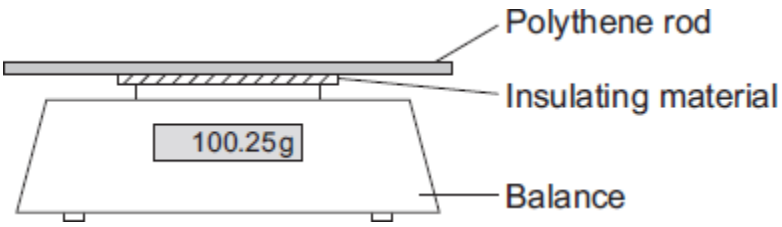
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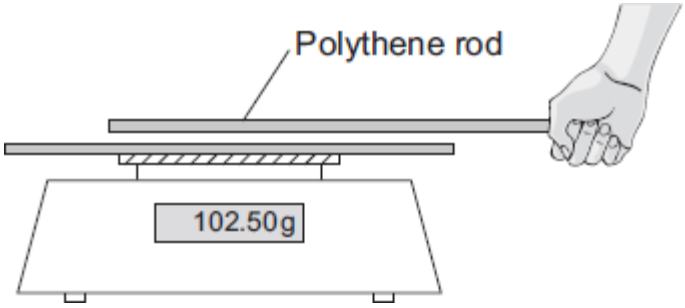
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**(2)**

(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.

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

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**(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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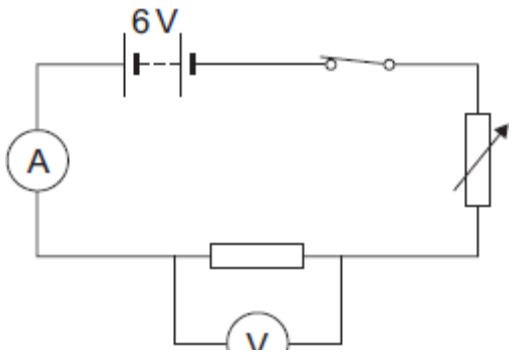
**(2)**

**(Total 6 marks)**

## Q3.

The diagram shows the circuit set up by a student.

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(a) The student uses the circuit to test the following hypothesis:

*'The current through a resistor is directly proportional to the potential difference across the resistor.'*

(i) If the hypothesis is correct, what should the student predict will happen to the current through the resistor when the potential difference across the resistor is doubled?

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_____

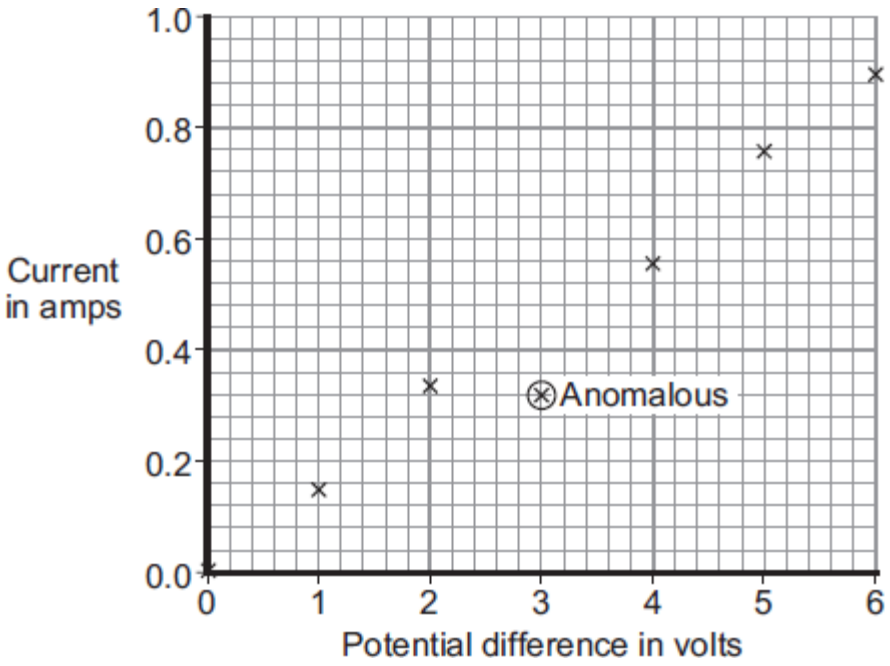
**(1)**

(ii) Name the component in the circuit used to change the potential difference across the resistor.

_____

**(1)**

(b) The student used the data obtained to plot the points for a graph of current against potential difference.




(i) Why has the student plotted the points for a line graph and not drawn a bar chart?

_____

_____

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**(1)**

(ii) One of the points has been identified by the student as being anomalous.

What is the most likely cause for this anomalous point?

_____

_____

**(1)**

(iii) Draw a line of best fit for these points.

**(1)**

(iv) Does the data the student obtained support the hypothesis?

Give a reason for your answer.

_____

_____

**(1)**

**(Total 6 marks)**

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