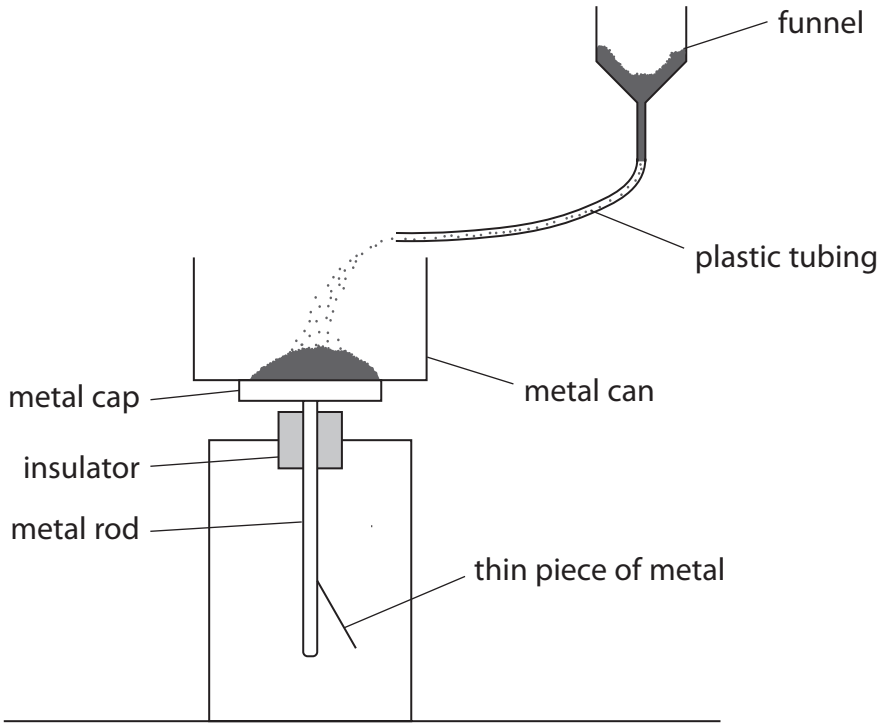
4 A student uses this apparatus to demonstrate the effect of electric charge.



He pours some fine powder into a funnel.

The fine powder moves through a length of plastic tubing and falls into a metal can.

The metal can rests on a metal cap.

The metal cap is connected to a thin piece of metal via a metal rod.

When the powder lands in the can, the thin piece of metal moves away from the metal rod.

(a) Explain why the thin piece of metal moves away from the metal rod.

(4)

(b) A coulombmeter measures electric charge.

The student connects a coulombmeter to the metal can.

When all the powder has landed in the can, the coulombmeter shows a reading of -9.4×10^{-9} C.

(i) Which statement is true for the metal can?

(1)

☒ **A** it gains negatively charged electrons

☒ **B** it loses negatively charged electrons

☒ **C** it gains positively charged electrons

☒ **D** it loses positively charged electrons

(ii) State the formula linking charge, current and time.

(1)

(iii) It takes a time of 12 s from when the powder starts landing in the metal can until all the powder has landed in the can.

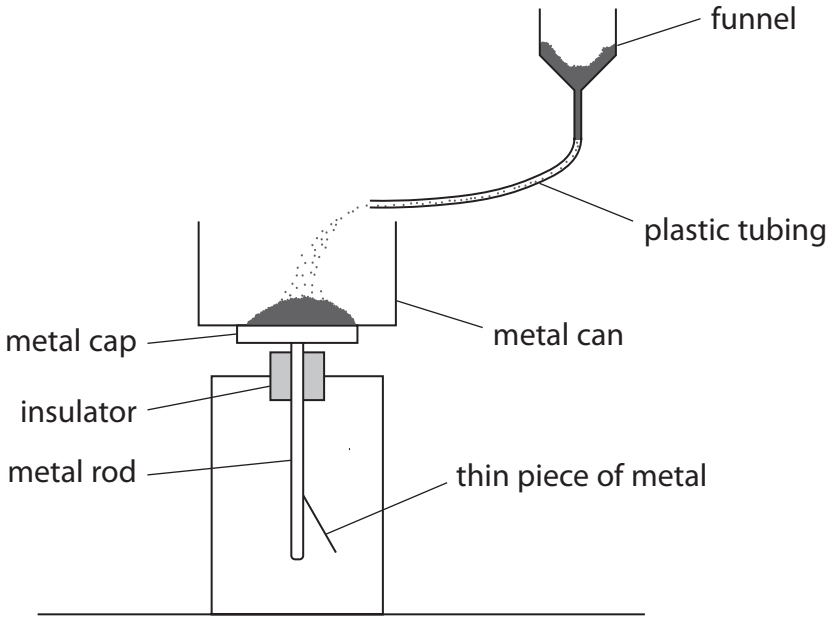
Calculate the mean charging current.

(3)

current = ... A

(c) The student suggests that this demonstration is similar to refuelling an aircraft.

The powder represents the fuel and the metal can represents the fuel tank in the aircraft.



Explain how the student should modify this apparatus to demonstrate how to minimise the dangers when refuelling an aircraft.

You may add to the diagram to help your answer.

(3)

(Total for Question 4 = 12 marks)