5

(a) State Coulomb's Law.

……

…….. [1]

(b) Two similar helium-filled spherical balloons A and B are tied to a 5.00 g mass with strings. Each of the balloons carries a charge q and floats in equilibrium (see Fig. 5.1).

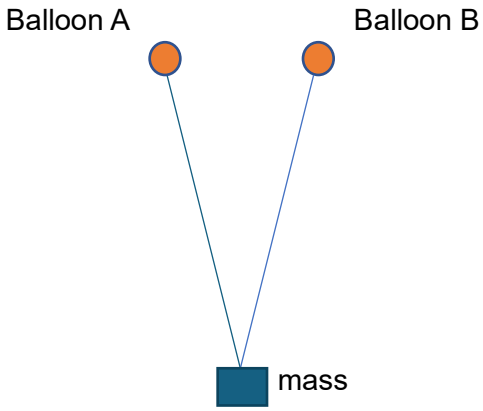

Fig. 5.1

(i) Given that the two balloons are 0.600 m apart horizontally, and the length of each string is 1.00 m, show that the tension in the string is 2.57×10^{-2} N

[2]

(ii) In Fig. 5.1, draw and label the forces acting on balloon B only. Do not neglect the weight of the helium gas inside the balloon but the weight of the rubber material of the balloon can be ignored. [2]

(iii) Calculate the magnitude of the charge q on each balloon.

q = …… C [2]

(iv) By considering the weight of the balloon as only due to the helium gas, calculate a value for the volume of the balloon B. The density of helium is 0.20 kg m^{-3} and that of air is 1.29 kg m^{-3}.

Volume = …… m^3 [3]

[Total: 10]