

- 3 (a) Define *electric potential* at a point.

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..... [1]

- (b) Two spherical conductors of radii r_1 and r_2 are separated by a distance *much larger* than the radius of either sphere. Initially, the charges on the spheres are q_1 and q_2 and the potentials are V_1 and V_2 respectively, as shown in Fig. 3.1.



Fig. 3.1 (not to scale)

The spheres are then connected by a conducting wire as shown in Fig. 3.2.

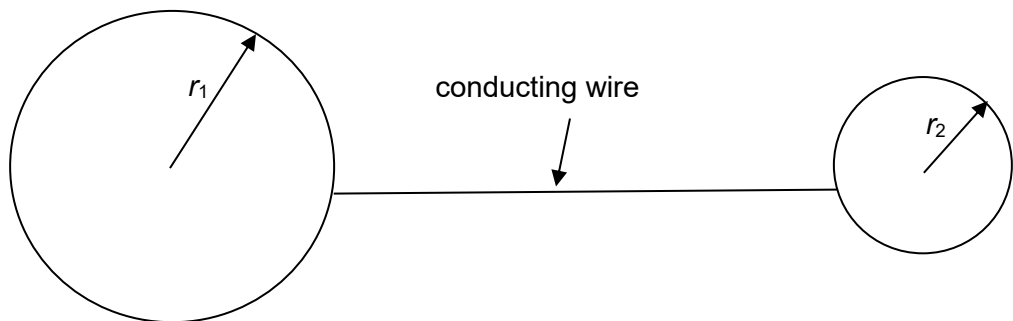


Fig. 3.2 (not to scale)

- (i) State and explain what happens to the potentials of the spheres upon connecting them with the conducting wire.

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 [2]

- (ii) Derive an expression for the electric potential V at the surface of the larger sphere, after the wire is connected, in terms of V_1 , V_2 , r_1 and r_2 .

State one assumption made in your derivation.

Assumption:

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 [3]

- (c) Three identical small spheres A, B and C, each carrying equal charge $+q$, are connected to three light non-conducting strings as shown in Fig. 3.3. Spheres A and C are deflected at the same angle θ with the vertical and the length of the strings connected to both spheres is L .

The three spheres lie on the same horizontal axis.

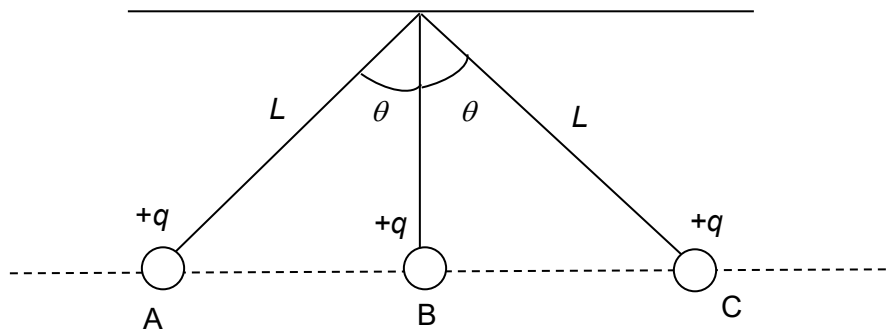


Fig. 3.3 (not to scale)

- (i) Write down an expression for the electric force F acting on A in terms of q , θ and L .

[2]

- (ii) Derive an expression for the tension T in the string supporting A in terms of q , θ and L .

[2]

- (iii) The charge on sphere B is increased. State the change, if any, in the positions of each of the spheres immediately after.

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..... [2]

[Total: 12]

