8 (a) Two ions S and T, each of negative charge $-q$, are held stationary at a distance of 2.0 cm from each other as shown in Fig. 8.1. P_1 is the midpoint between S and T.
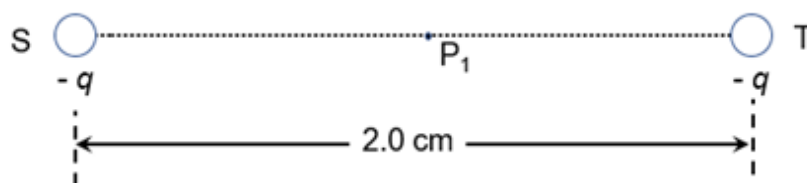

Fig. 8.1

State what it means by

(i) the *electric field strength* at P_1,

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.... [1]

....

(ii) the *electric potential* at P_1.

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.... [1]

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(b) The value of q is known to be 1.6 x 10^{-19} C. A third ion R of positive charge $+q$ is introduced into the system at a distance of 4.0 cm from ions S and T as shown in Fig. 8.2. All three ions are held stationary.
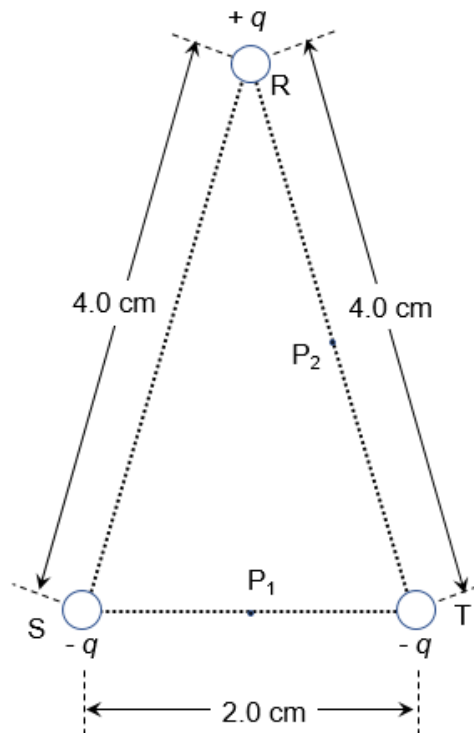
P_2 is the midpoint between R and T.

Fig. 8.2

(i) Calculate the amount of work done required to assemble R.

work done = …………………………..…………… J   [3]

(ii) Without calculations, explain whether the work done required is more or less if R were to be placed at P_2 instead.

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……………………………………………………………………………………………   [2]
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(iii) With reference to the direction of the electric field strength along RP_1, describe the variation of electric potential along the line joining ion R to the point P_1.

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(c) (i) Show that the magnitude of the electric field strength that R experiences for the ion assembly in Fig. 8.2 is given by 1.74×10^{-6} N C^{-1}.

[4]

(ii) R is subsequently released.

Hence, calculate
1. the magnitude and state the direction of the resultant force on R just as
it is released,

force = ………………………………… N

direction : ………………..………………………………… [3]
2. the magnitude of the initial acceleration of R if it has a mass of 2.58×10^{-26} kg.

acceleration = ………………………………… m s^{-2} [2]

(d) Suggest with a reason, the subsequent motion of R after passing through the line joining
S and T.

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....   [2]