4 Two point charges A and B each have a charge of $+6.4 \times 10^{-19}\,$C. They are separated in a vacuum by a distance of 12.0 µm, as shown in Fig. 4.1.

Fig. 4.1

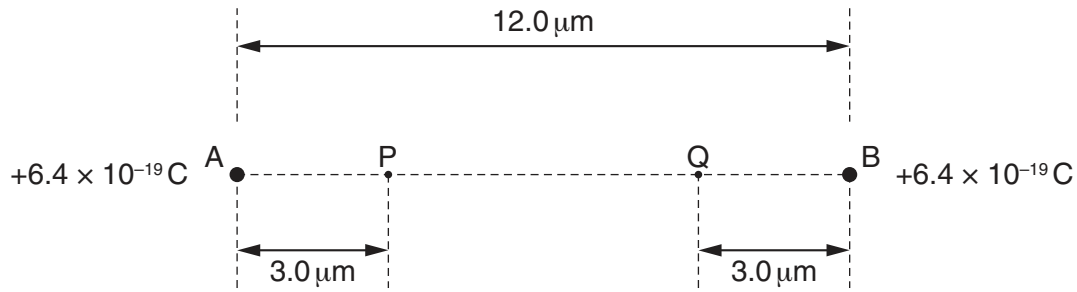Points P and Q are situated on the line AB. Point P is 3.0 µm from charge A and point Q is 3.0 µm from charge B.

(a) Calculate the force of repulsion between the charges A and B.

force = ... N [3]

(b) Explain why, without any calculation, when a small test charge is moved from point P to point Q, the net work done is zero.

....

....

.... [2]

(c) Calculate the work done by an electron in moving from the midpoint of line AB to point P.

work done = ... J [4]