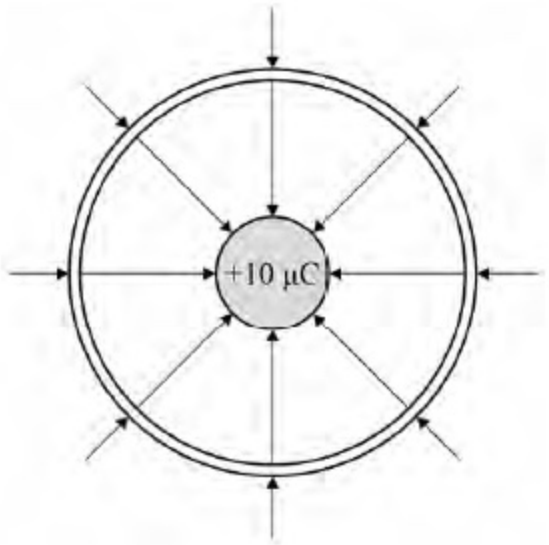
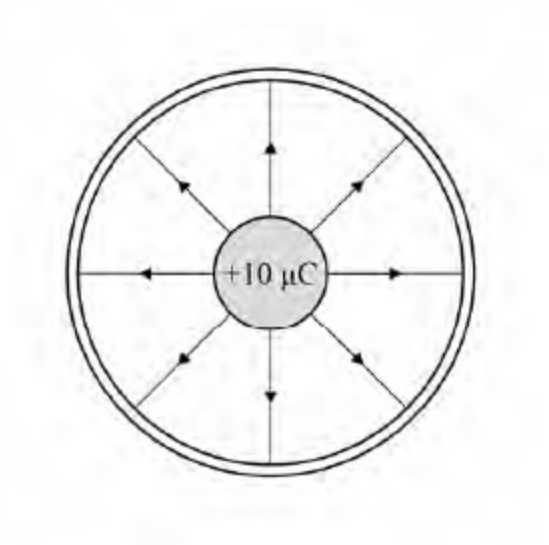
1 A conducting sphere holding a charge of +10 μC is placed centrally inside a second uncharged conducting sphere.

Which diagram shows the electric field lines for the system?

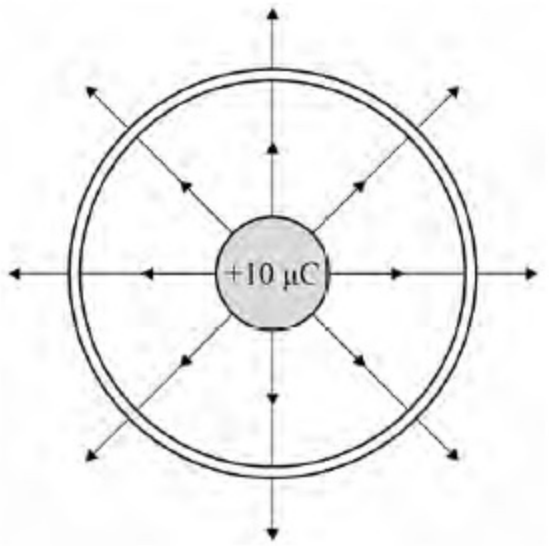
A



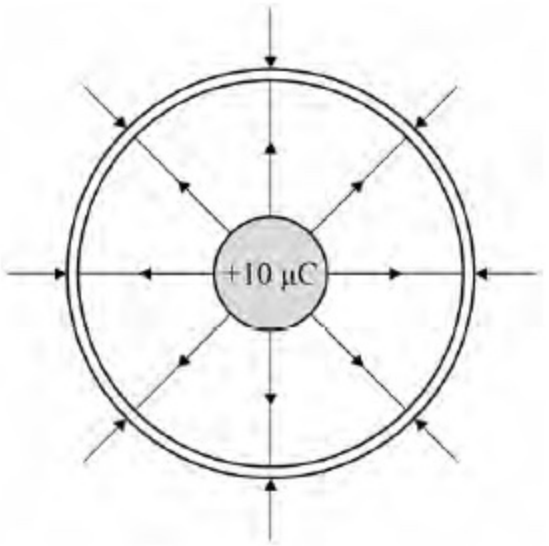
B



C



D



A ⬭

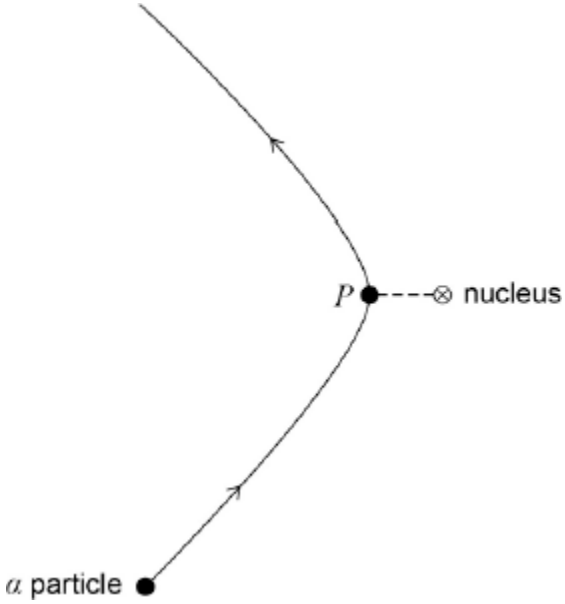
B ⬭

C ⬭

D ⬭

(Total 1 mark)

2 The diagram shows the path of an α particle deflected by the nucleus of an atom. Point P on the path is the point of closest approach of the α particle to the nucleus.



Which of the following statements about the α particle on this path is correct?

A Its acceleration is zero at P. ⬭

B Its kinetic energy is greatest at P. ⬭

C Its potential energy is least at P. ⬭

D Its speed is least at P. ⬭

(Total 1 mark)

3 (a) State, in words, Coulomb's law.

_____

_____

_____

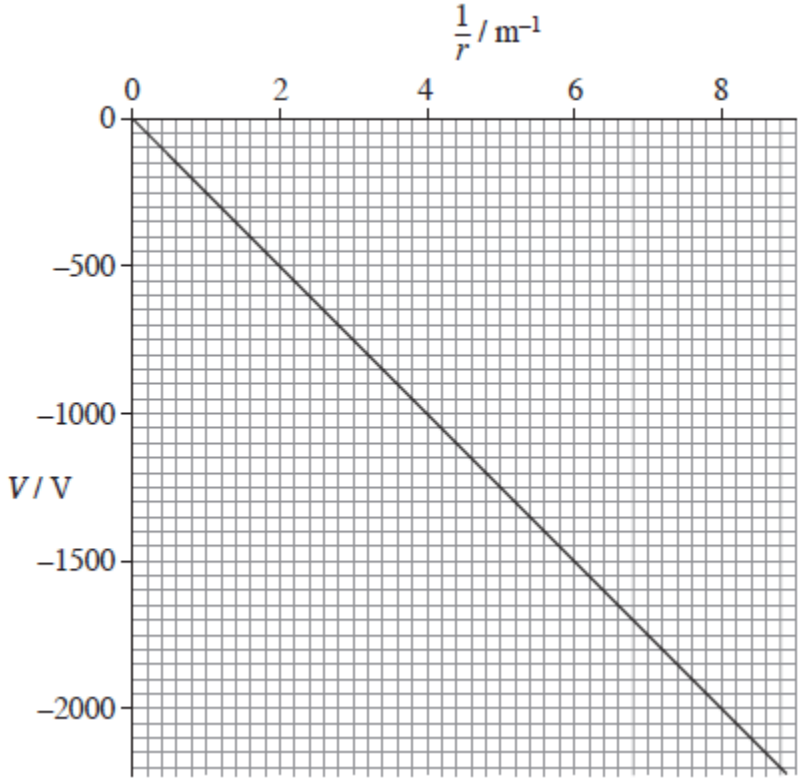
_____

_____

_____

(2)

(b) The graph shows how the electric potential, V, varies with $\frac{1}{r}$, where r is the distance from a point charge Q.



State what can be deduced from the graph about how V depends on r and explain why all the values of V on the graph are negative.

_____

_____

_____

_____

(2)

(c) (i) Use data from the graph to show that the magnitude of Q is about 30 nC.

(2)

(ii) A +60 nC charge is moved from a point where r = 0.20 m to a point where r = 0.50 m. Calculate the work done.

(2)

work done _____ J

(iii) Calculate the electric field strength at the point where r = 0.40 m.

electric field strength _____ V m^{-1}

(2)

(Total 10 marks)

4 (a) State, in words, Coulomb's law.

_____

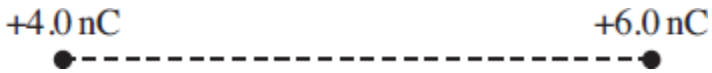
_____

_____

_____

(2)

(b) The diagram below shows two point charges of +4.0 nC and +6.0 nC which are 68 mm apart.



(i) Sketch on the diagram above the pattern of the electric field surrounding the charges.

(3)

(ii) Calculate the magnitude of the electrostatic force acting on the +4.0 nC charge.

magnitude of force _____ N

(2)

(c) (i) Calculate the magnitude of the resultant electric field strength at the mid-point of the line joining the two charges in the diagram above.
State an appropriate unit for your answer.

electric field strength _____ unit _____

(4)

(ii) State the direction of the resultant electric field at the mid-point of the line joining the charges.

_____

(1)

(Total 12 marks)