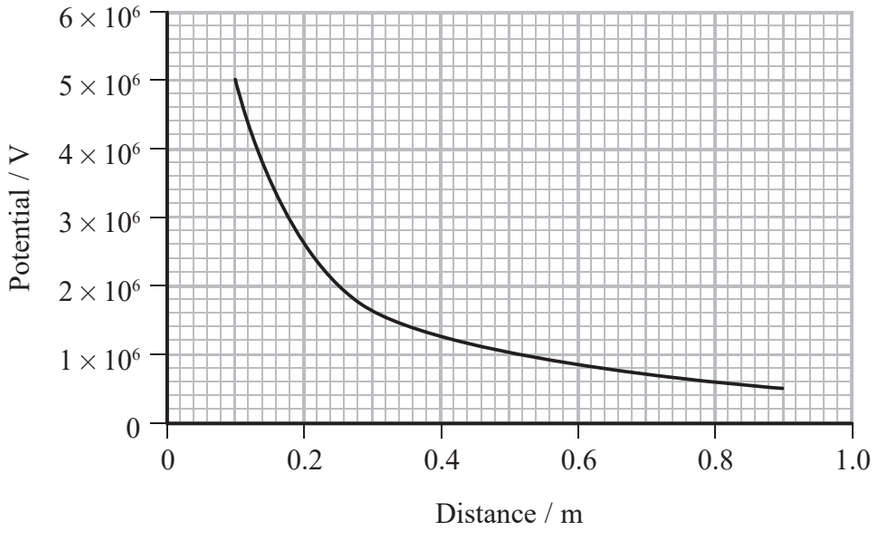
16 (a) Sketch the electric field around a positive point charge.

(3)

(b) The graph shows how potential varies with distance from the centre of a charged sphere.



Air molecules will be ionised if the electric field strength exceeds $3 \times 10^6\,V\,m^{-1}$.

Deduce whether air molecules will be ionised at a distance of 30 cm from the centre of this sphere.

(4)

(c) A magician did a trick which he claimed was the most dangerous ever. He positioned himself midway between two charged spheres which were separated by a distance of about two metres. Each sphere was charged to a potential that would cause ionisation at a distance of one metre. He wore a protective suit of chain mail and a helmet consisting of a metal cage. The protective suit and helmet were earthed to a potential of 0 V.

A scientist said "there is no danger in this and I would happily do it tomorrow".

Explain whether this statement is justified.

(3)

(Total for Question 16 = 10 marks)