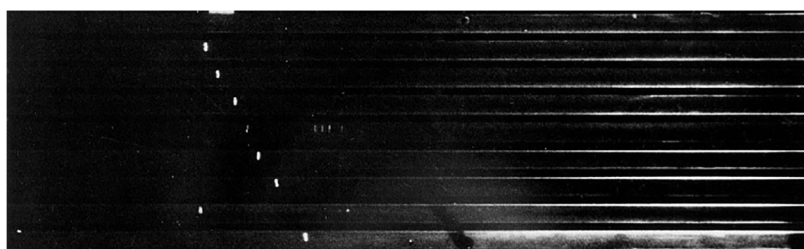


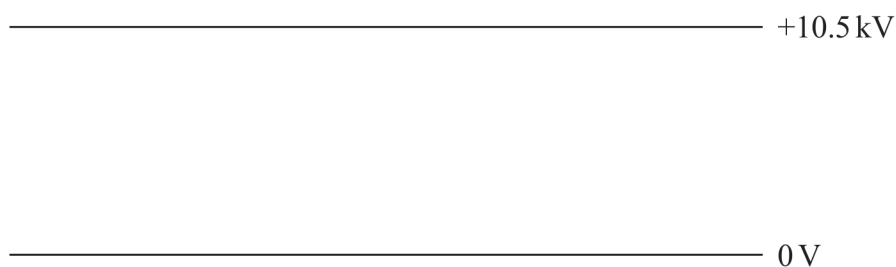
- 16 A spark chamber consists of a set of parallel metal plates. It can reveal the path of a high energy particle as shown.



parallel metal plates

(Source: © Smith Collection/Gado/Contributor/Getty Image)

A potential difference of 10.5 kV is applied across two adjacent plates as shown below.



- (a) Sketch lines to represent the electric field between the plates. (3)
- (b) A high energy particle causes ionisation of the atoms in the space between the plates.
- (i) Show that the force on an ionised atom due to the electric field is about  $2.6 \times 10^{-13} \text{ N}$ .

charge on ionised atom =  $1.60 \times 10^{-19} \text{ C}$

distance between plates = 6.40 mm

(3)

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- (ii) The ionised atom travels  $0.2\text{ }\mu\text{m}$  in the direction perpendicular to the plates before colliding with another atom.

Deduce whether the collision could lead to further ionisation.

ionisation energy of atoms =  $3.9 \times 10^{-19}\text{ J}$

(2)

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- (c) Most of the particles detected in the spark chamber are muons. The muons were created in the upper atmosphere. Muons normally have a very short lifetime and should have decayed before they reach the surface of the Earth.

Explain why these muons reach the surface of the Earth.

(3)

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